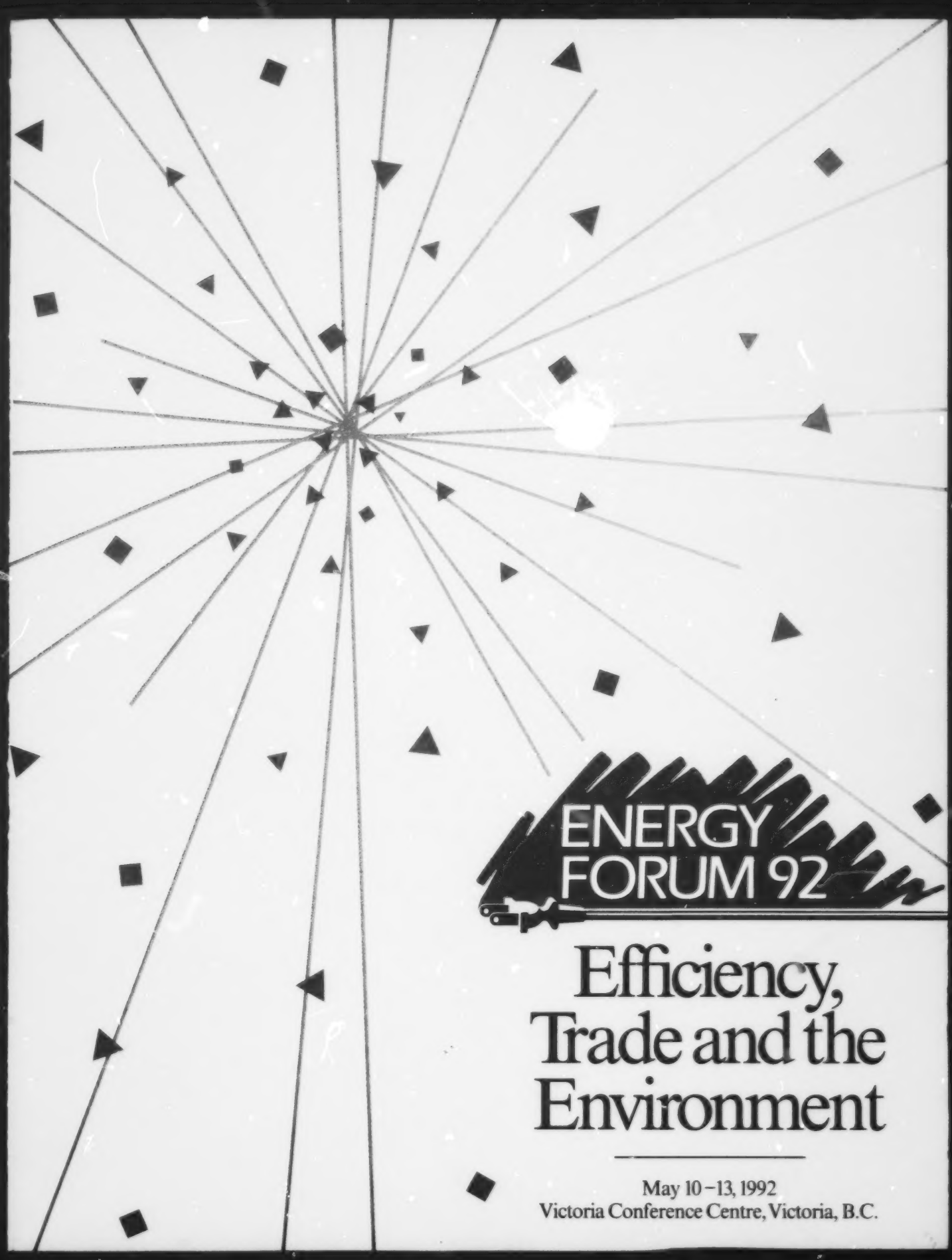

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

93-02334/

British Columbia Cataloguing in Publication Data
Electric Energy Forum
Proceedings. – 1st (1988) –

Annual.
Sponsored by B.C. Hydro; Ministry of Energy, Mines and Petroleum Resources; Ministry of Environment, Lands and Parks and the Energy Council of Canada.

ISSN 0840 – 884X

1. Electric power – British Columbia – Congresses. I. B.C. Hydro. II. British Columbia. Ministry of Energy, Mines and Petroleum Resources. III. British Columbia. Ministry of Environment, Land and Parks. IV. Energy Council of Canada.

HD9685.C33B73 333.79'12'09711

October 1992

Additional funding was provided through the generosity of the following Companies and organizations:
POWEREX
PowerSmart
Power Smart Inc.
West Kootenay Power
Powerserv Pacific Inc.

Typesetting and Production Design Management by Patrick J. Meehan, Vancouver
Printed in Canada on recyc[illegible]d and recyclable paper by Gastown Printers Ltd.

ENERGY FORUM 92

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre
Victoria, B.C.

Sponsored by

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Summary

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

SUMMARY

B.C. Hydro's Fifth Annual Electric Energy Forum was held at the Conference Centre in Victoria from Sunday, May 10 to Wednesday May 13, 1992. This year's Forum was held jointly with the 14th Canadian National Energy Forum as one event, Energy Forum '92. The Forum provided an opportunity for delegates from utilities, government, industry, international development agencies, environmental groups, universities, and interested members of the public to discuss major energy issues of today and tomorrow.

Energy Forum '92 was jointly sponsored by B.C. Hydro, the Energy Council of Canada (formerly CANWEC), and by the Provincial Ministries of Energy, Mines and Petroleum Resources and Environment, Lands and Parks. Other supporting agencies were Power Smart, POWEREX, West Kootenay Power, PowerServ Pacific Inc. and Power Smart Inc.

Energy Forum '92 addressed the important energy issues of the coming decade. Participants were invited to explore three main themes:

- Efficiency - The latest developments in energy-efficient technologies and their role in moving the global economy towards sustainable development.
- Trade - Strategies for trade in energy and related technologies, including an emphasis on North America's relations with Pacific Rim and Latin America.
- Environment The effects of energy production, use and trade on the local, regional and global environment.

Over 450 delegates registered for Energy Forum '92, a record attendance from over 50 non-profit environmental organizations, aboriginal bands and educational groups from throughout British Columbia and the Pacific North-West. A number of delegates from twelve overseas and developing countries registered, including a group from the People's Republic of China.

Sunday, May 10

Energy Forum '92 was opened on Sunday evening by conference Chair John Sheehan, Vice-President, Environmental and Corporate Affairs, B.C. Hydro. His brief opening remarks were followed by a welcome to the delegates by Ms. Jan Greenwood, Deputy Mayor of Victoria, and by the Honourable Anne Edwards, Minister of Energy, Mines and Petroleum Resources(British Columbia). A further welcome to the Conference was given by Bob Wyman, CEO of B.C. Hydro, and by Scotty Cameron, 1992 Chairman of the Energy Council of Canada and CEO of Pan-Alberta Gas. The reception following gave delegates an opportunity to meet and greet colleagues and friends before the formal sessions began.

Monday, May 11

The initial Monday session, chaired by Dr. John Foster, President of the World Energy Council, addressed the issue of 'Energy in a Global Context.' Dr. Foster stated that Canada has a large, relatively balanced trade in petroleum and petroleum products, and exports nearly one-third of its production of natural gas, a large amount of coal and as much as 10 percent of its electricity production. He went on to note that Canada exports, or has committed to export uranium which will provide more potential energy than is available in all the country's oil, gas, coal, and tar sand resources combined.

The keynote address, entitled 'Changing Patterns of Energy Trade,' was given next by Derek Davis, Executive Director, World Energy Commission.

He said that, "The basic problem with energy is the same as the basic problem with food. We have plenty of it now and are likely to have plenty of it in the future but the distribution is faulty. The pattern of supply does not match the pattern of demand and many who have enough waste an awful lot of it. And as with food, the situation would be immeasurably worse without trade in the commodity. But trade is not the whole solution to the problem of energy poverty any more than it is the solution to the problem of hunger. People need to be able to buy food and energy but they also have to be able to grow their own food and they have to be able to provide their own energy, particularly if they cannot afford to buy. The challenge to the global energy industry in 1992, looking ahead to and through the first half of the next century, is to provide energy through trade."

The keynote address was followed by Dr. David Scott, Director of the Institute for Integrated Energy Systems, University of Victoria, whose speech was entitled 'The Architecture of Our Evolving Energy Systems.' He pointed out that people do not use energy; they use the services that energy provides. He used the illustration that people plugging a computer into a wall socket to get an answer to an arithmetic problem are indifferent to whether the electricity to run the computer came from a nuclear plant or a solar cell. Electric energy is simply a means to an end: what they want is an answer. We should not be preoccupied with extrapolating when energy supplies will run out; we should instead focus on the services people require and look to new ways of providing their needs, perhaps using radically new technologies for which there will be no energy shortages. Dr. Scott forecasts an increasing use of natural gas as a preferable low greenhouse gas fuel in the near term, with hydrogen as a possible fuel for automobiles and airplanes in the more distant future, complimented by electricity for stationary power requirements.

The final speaker in the first morning session was by Dr. John Hollins, Associate Senior Science Advisor with Environment Canada, in Ottawa. His topic was 'Environmental Constraints on the Earth's Energy System.' He discussed a large linear-programming energy model that can locate least-cost solutions for postulated future energy requirements for regions such as Ontario and Quebec. If greenhouse gases are constrained to 1990 levels and energy demands continue to grow at modest rates in the future, even if all feasible energy conservation measures are deployed, the model indicates large shortfalls of energy in these provinces, for which the only feasible supply within greenhouse gas constraints would be electricity from additional nuclear plants.

After a mid-morning coffee break, a panel was convened to discuss 'Western Canadian Energy in a Global Context.' The panel moderator was Dr. Judith Myers, Professor of Plant Science and Zoology and Associate Dean of Science at the University of British Columbia. Panellists were R. Murray Fraser, Vice-President, Manitoba Hydro; Ian Smyth, President, Canadian Petroleum Association; Giacomo Capobianco, President and CEO, Coal Association of Canada; and Bill Gatenby, Chairman, Cameco Corporation. The panellists outlined the current domestic and foreign markets for electricity, petroleum and natural gas, coal and uranium. Despite increasing public awareness and concerns about environmental impacts and the future effects of greenhouse gases from combustion, all panellists were confident that Canada will continue to earn valuable foreign revenue from export sales from all of these commodities in future, largely to the United States. Following the panellists' presentations, Dr. Myers handled a lively discussion from the audience, both from written questions and from questions directed to the panellists from the microphones in the theatre.

The luncheon speaker on Monday was Mr. Bob Jamieson, from the B.C. Round Table on the Environment and the Economy, and Past President of the Wilderness Tourist Council of B. C. Mr. Jamieson's presentation was based on the March, 1992 report of the British Columbia Round Table on the Environment and the Economy, entitled 'A Sustainability Strategy for Energy.' Using a consensus-based approach, the B.C. Round Table brings together the interests, experience and ideas of people in every region and economic sector of the Province to develop a strategy for energy sustainability in British Columbia. Their report contains a number of recommendations directed to the Provincial Government.

After the luncheon, delegates were offered a choice of two concurrent programs. Energy Forum attendees were invited to participate in one of three public discussion workshops running from 2.15 to 5:00 p.m., arranged by Jim Savage, of Savage and Associates. The workshops proved to be very popular and all three were filled to capacity. The topics offered were:

- Columbia River Basin - A Step Towards Integrated Resource Use
- Electricity Trade - Benefits and Costs
- Planning and Choices - The Future of Electricity Planning

The Energy Council of Canada's concurrent program consisted of two discussion panels. The first, chaired by Dr. Stan Hatcher, President, Atomic Energy of Canada, addressed the issue, 'Efficiency and Competitiveness.' Panellists were Morgan MacRae, Director, Coal and Electricity Research, Canadian Energy Research Institute, whose topic was 'How Do We Measure Efficiency?'; W. Peter Torbet, Chairman, Canadian Industry Program for Energy Conservation, whose topic was 'What Is the Experience?'; and Jack Habart, Manager, Planning and Evaluation, B.C. Hydro, who spoke on 'What Is the Potential?'

Mr. MacRae warned that using the ratio of energy divided by GDP, an index for comparing efficiency of use of energy resources between countries, could lead to

misunderstandings. Our goal should be to minimize the cost of production throughout the world, not to minimize the use of energy resources. For example, when refining aluminium, the objective should be to produce the lowest-cost aluminium, not to minimize the electricity used in its production.

Jack Habart reported on a B.C. Hydro study currently nearing completion which examined the energy savings possible if industrial electricity customers adopted all technically-feasible electric energy conservation measures that were less expensive than the cost of new energy resources, when evaluated using a discount rate of 8 percent. Results for the industrial sector are now available, and indicate that the pulp and paper industry could achieve further electric energy savings of up to 42%; in mining, up to 25%; in chemicals, up to 23%; and in wood products, up to 19%.

A lively question period followed the panellists' presentations.

After a break, the second panel discussion was convened, also moderated by Dr. Stan Hatcher. The first panellist was Mr. Duncan Taylor, Manager, Economics and Forecasts, Ontario Ministry of Energy, who spoke on 'Energy Efficiency in Industry - Ontario Experience.' He was followed by Mr. Leo Flaman, Vice-President and Senior Consultant, Power Division, Monenco Ltd., Alberta, whose topic was 'Energy Efficiency Technology - Supply-Side Management.' The final panellist was Dr. Carl Beigie, Chairman, Canadian Foundation for Economic Education, who spoke on 'International Trade and Competitiveness.' Again, an active question period consisting of written and oral questions followed until the session ended at 5:00 p.m.

At 5:00 p.m, a signing ceremony of a 'Memoranda of Understanding' took place in the Conference Centre foyer between representatives of the Federal Department of Energy, Mines and Resources, B.C. Hydro, and Centra Gas British Columbia Limited, to formalize the participation of these two provincial utilities in the new 'Federal Buildings Initiative,' a program designed to improve energy utilization in federal buildings across Canada. B.C. Hydro and Centra Gas are the first two Canadian utilities to become involved in this initiative, which is expected to reduce energy bills for federal government departments and contribute to sustainable development. Mr. Bob Wyman signed this initiative on behalf of B.C. Hydro, Mr. Ken Rekrutiak signed on behalf of B. C. Gas and Mr. John MacDougall, Parliamentary Secretary for Energy Minister Jake Epp, signed on behalf of the Federal Government.

The final event on Monday, May 11 was a Reception and Banquet for all delegates. An overflow crowd enjoyed an excellent dinner, which was followed by an address by John MacDougall. Mr. MacDougall spoke in place of the scheduled speaker, the Honourable Jake Epp, Minister of Energy Mines and Resources, who was unable to attend the Forum because of the Westray coal mine disaster in Nova Scotia.

Tuesday, May 12

An optional 7:30 a.m. breakfast meeting sponsored by the B. C. Environmental Network (B.C.E.N.) was the first event on the Tuesday program. Over breakfast, Mr. Phil Larstone, President of the B. C. Energy Caucus, discussed the April 1992 report of the B.C.E.N. entitled 'Energy and the Environment, What the British Columbia Government Can Do.' This document contains 39 recommendations on specific actions the B.C. Government could adopt to achieve a more sustainable future for the citizens of British Columbia. Following Mr. Larstone's presentation, a discussion panel answered questions from the floor. Mr. Larstone urged all Forum delegates to help publicize the B.C.E.N. Report with their families and colleagues.

The formal Tuesday morning session entitled 'Energy Imperatives,' was chaired by the Right Honourable Ed Schreyer, former premier of Saskatchewan and Governor-General of Canada.

He introduced Hemas (Bill Wilson), Political Secretary for the Assembly of First Nations and Political Coordinator of the Musgamagw Tribal Council of the Kwakiutl Nation (Comox, Vancouver Island) who gave an impassioned Keynote address 'Energy Decision Making - A First Nations Perspective.' He pointed out that for Native People, their dealings with whites and government authorities over the years was a long record of broken promises, of which the most recent example was the agreements signed by the Inuit and Crees in Northern Quebec. He claimed that every clause in these agreements was broken before the ink was dry on the documents.

He noted that one of the key obligations he learned in his training as a chief was that "The weakest among us are the ones who should be protected." In white society, it seems the opposite is true.

Decisions of vital importance to native bands are often made in distant boardrooms with no consultations with the people involved. He claimed that for many native people living along the Peace River in the early 1960s, the first they knew of the construction of the Bennett Dam was to see their villages and graveyards disappear beneath the rising waters. He ended his speech with a ringing demand for respect for all native people in future. After a stunned silence at the end of Hemas' speech, the audience awarded him a thunderous round of applause and a standing ovation. Ed Schreyer directed a number of questions from the audience to Mr. Wilson before he was obliged to leave the Forum at 10:15 a.m. to attend another commitment.

The next speaker, Nancy Cooley, is President of Cooley/Olsen Inc. and has taken a lead role in the

planning and development of B.C. Hydro's Power Smart initiative. She is currently Chair of the Collaborative Committee for the 1991 Conservation Potential Review, the first collaborative process undertaken by the utility industry in Canada. This committee is jointly sponsored by B.C. Hydro and West Kootenay Power. Her talk, entitled 'Estimating Electricity Conservation Potential - a Collaborative Process,' described how a group of volunteers drawn from a wide spectrum of organizations from throughout B. C. met during 1991 and how this collaborative committee was able to reach a unanimous consensus on estimates of technological, social and economic conservation potentials for industrial customers in British Columbia. Their work on residential and small commercial conservation potentials is now nearing completion and will be reported on in the future, with Phase II, Achievable Conservation Potentials, to follow.

The last speaker of the first morning session was Mr. Doug Russell, the Director of Environment Canada's office established to develop Canada's positions for the international negotiations on a Framework Convention on Climate Change. As Senior Policy Advisor for the Atmospheric Environment Service, Mr. Russell led the development of the atmospheric issues sections of Canada's Green Plan. Mr. Russell spoke on 'Canadian Position on Climate and Atmospheric Change and the United Nations Conference on Environment and Development (Brazil '92).' He discussed increasing levels of human-made greenhouse gases being released into the atmosphere – the real culprits behind global warming. He noted that the Intergovernmental Panel on Climate Change had concluded in its 1990 report that concentrations of greenhouse gases in the earth's atmosphere are rising very rapidly:

- Half the CO_2 added to the atmosphere in all human history has been emitted in just the last 30 years.
- Methane levels have doubled in the past 100 years.
- CFC levels are doubling every 10-20 years.

About three-quarters of the warming to date can be attributed to CO_2, emitted by the burning of fossil fuels for transportation and energy production, from deforestation and from industrial processes. Canada produces 2% of the world's CO_2 emissions, but is the second largest emitter on a per-capita basis among industrialized nations. However, CO_2 emissions from China, India, the USSR and less-developed nations are growing rapidly and will accelerate global warming trends. The Brazil '92 conference will try to develop a strategy to reduce the emissions of greenhouse gases. Canada's position is to stabilize CO_2 emissions at 1990 levels by the year 2000.

Because of time, questions to Nancy Cooley and Doug Russell were deferred until after the morning break at 10:15 a.m.

At 10:30 a.m., the Forum split into two concurrent sessions. Delegates were offered a choice of joining the second Electric Energy Forum discussion workshops or attending an Energy Council of Canada panel discussion.

The Discussion workshops proved very popular: all sessions were filled. Three discussion topics were offered on Tuesday morning:

- Alternative Energy Issues for the 90s.
- B.C. Hydro and Public Involvement.
- B. C. Round Table on the Environment and the Economy: A Sustainable Strategy for Energy.

The concurrent Energy Council of Canada Panel Discussion, 'Trading Western Canadian Energy,' was chaired by the Right Honourable Ed Schreyer. The first panellist, Guy Saint-Jacques, Energy Councillor, Canadian Embassy, Washington, D. C., spoke on 'Energy Issues Between the U.S.A. and Canada.' He was followed by Lorne Seitz, former President and CEO of the B. C. Trade Development Corporation, the B.C. Provincial government agency responsible for trade development, who spoke on 'Pacific Rim Trade - B.C. Perspective.' The final panellist was Gary Fuqua, Deputy Assistant Administrator, Office of Energy Resources, Bonneville Power Administration, whose title was 'West Coast Electricity Trade.'

Mr. Saint-Jacques defended the free-trade agreement with the United States. He said, "Free trade means the freedom to sell and the freedom to buy. That is the basic bargain ... The commercial reality is that prosperity cannot be built on resources left in the ground. If we are to insist on secure and stable rules for selling our products, our buyers are entitled to the same rules. That is what the free trade agreement enshrines for energy. We expect no less, and we can offer no less, if we want to sell."

Mr. Seitz discussed the rapid development of Asian economies around the Pacific Rim, with corresponding ever-increasing demands for energy and raw materials. These demands offer western Canada ongoing opportunities for exports of non-metallurgical coal, sales of technical expertise for the design and construction of new power plants, coal ports, rail infrastructure, etc.; but all these opportunities will require access to financing on acceptable terms.

Gary Fuqua discussed the historical exchanges of secondary hydroelectric energy and capacity between Canada and the United States that followed the completion of the Columbia River Treaty projects in the late 1970s. Recent designation of the wild salmon as an endangered species will require changes in operation of the treaty storage dams and may reduce BPA's firm load-carrying hydroelectric capacity by as much as 400 average megawatts. The return of the Columbia River Treaty downstream benefits beginning in 1997 is currently being factored into BPA's resource planning. In

view of these demands, Mr. Fuqua expected that there would continue to be opportunities for Canadian electricity trade into the Pacific Northwest.

A spirited question period followed the panellists' presentations. Moderator Schreyer directed a number of written questions to the speakers while questioners lined up behind both floor microphones to direct questions to the speakers.

Luncheon at 12:30 was followed by an address by the Honourable Anne Edwards, Minister of Energy, Mines and Petroleum Resources(British Columbia). In her address she explained the role of the new B. C. Energy Planning Council, directed by Dick Gathercole, which will examine all aspects of energy developments in British Columbia, and which will seek public input for their planning deliberations on issues such as electricity exports. Thanks to the speaker, on behalf of the delegates, were extended by Phil Larstone of the B. C. Environmental Network.

The Tuesday afternoon 'Wrap Up' session was chaired by John Allan, Deputy Minister, Energy, Mines and Petroleum Resources(British Columbia). The first speaker was Jim Savage, Principal, Savage and Associates, who reported back on the discussion sessions held Monday afternoon and Tuesday morning. He asked one member from each of the six workshop sessions to join him on the stage and give a brief summary of what they felt their workshop had accomplished.

These were Maura O'Neill, who summarized the workshop on 'Electricity Trade;' Mike Talbot, who summarized the workshop on 'Planning and Choices;' Ezra Auerbach, who summarized the workshop on 'B.C. Hydro and Public Involvement;' Lee Doney, who summarized the workshop on the 'B.C. Round Table on the Environment and the Economy: A Sustainable Strategy for Energy;' Bob Evans, who summarized the workshop on 'Alternative Energy Issues for the 90s' and Glen Sinclair, who summarized the workshop on 'The Columbia River Basin: A Step Towards Integrated Resource Use.'

Mr. Savage then invited questions and comments on the workshops from the floor. One delegate felt that the B. C. Environmental Network's report 'Energy and the Environment, What the B.C. Government Can Do' should have been given a higher profile at the workshops. Another thought there should be more high-school students in attendance. He suggested that each organization sending a delegate to future Energy Forums should sponsor the attendance of a student as well.

Next, Dr. Stan Hatcher summarized what he believed the Energy Forum '92 had achieved. He felt that it would help prepare the Canadian delegates' position at the upcoming World Energy Conference in Madrid this autumn. He stressed the critical importance of strategic thinking in addressing these future challenges. He went on to say that, "The prospect, as we've heard yesterday and we are hearing more and more frequently these days, is of a world in the middle of the next century with a population exceeding 10 billion people. Even if we adopt heroic energy conservation measures in countries like Canada, the world is still going to consume twice as much energy as it does today if the developing countries are going to have even a chance at a good standard of living. And we know that fossil fuels are still going to account for the majority of that energy."

After a short break, the final panel discussion group for the Tuesday Session was convened, to address 'Energy Development in Canada - Where Do We Go from Here?' This panel of Provincial Cabinet Ministers was chaired by Mark Eliesen, Chair and CEO of Ontario Hydro. The panellists were the Honourable James Downey, Minister of Energy and Mines (Manitoba); the Honourable Anne Edwards, Minister of Energy, Mines and Petroleum Resources (British Columbia); and the Honourable John Penner, Minister of Energy and Mines (Saskatchewan).

Following their presentations, a number of written and oral questions were directed to the panellists.

At 4:40 p.m., Mr. Ray Hunt, President and Chief Operating Officer, B.C. Hydro, made his closing remarks for Energy Forum '92. He thanked all delegates for attending and said that B.C. Hydro was pleased to have been able to combine its 5th Annual Energy Forum with the 14th Regional Forum of the Energy Council of Canada. He thought the synergy had worked well, and had established a good model that can be used for future cooperation with the Energy Council of Canada. He noted that Hydro does attempt to respond to the feedback received from past Forums and that the feedback received from the participants was appreciated. This year, a number of changes had been introduced, such as the microphones on the floor for some oral questions to support the written questions. Hydro had also tried some stakeholder participation in the planning of the workshop sessions, which he felt had proved valuable. As well, Hydro had introduced the delivery of discussion papers to early registrants in advance of the Forum to help focus some of the panel discussions, and this had helped facilitate the process and make the workshops more efficient. He ended with an invitation to attend the Sixth Annual Electric Energy Forum, which will againbe held at the Victoria Conference Centre, on May 2nd to 5th, 1993.

On Tuesday evening, a special banquet for overseas delegates, jointly sponsored by the Canadian International Development Agency (CIDA) and by B.C. Hydro, was held at the Royal Victoria Yacht Club.

Wednesday, May 13

A final morning session of Energy Forum '92 was

held on Wednesday 13 May, for international delegates and registrants from the Energy Council of Canada. This Session, entitled 'Technology Transfer to Developing Countries,' was in the form of two panel discussions, both chaired by Mr. Colin Smallridge, who is a Director and past Chairman of the Energy Council of Canada.

The first panel discussion, which addressed the topic 'Energy Technologies Required by Developing Countries,' had five speakers. These were Mr. Eduardo Lobatón Gonzales, Director, Electrical Systems Division, of the Electrical Research Institute in Mexico; Saeed Akhtar Niazi, General Manager, Planning, in the Planning (Power) Division of the Pakistan Water and Power Development Authority; Mr. Swarng Champa, Deputy General Manager of Hydro Power and Transmission System Development with the Electricity Generating Authority of Thailand; Mr. John Ritchie, Vice-President and Regional Manager, responsible for the British Columbia operations of Acres International Ltd.; and Mr. Tom Drolet, Director of New Business Ventures, Ontario Hydro.

Following a question period and coffee break, the final panel convened, to address the topic 'Transfer of Technology from the Industrial World - Problems and Prospects.' Panellists were Anthony Churchill, Director, Energy and Industry Department, World Bank; Mme. Danielle Wetherup, Vice-President, Professional Services Branch, CIDA; Mr. Peter Koelbleitner, Vice-President and General Manager, ASEA Brown Boveri Combustion Systems Division; and Mr. Bill Pearson, Vice-President AGRA Engineering. After each of the speaker's presentations were completed, both panels joined Mr. Smallridge on the stage for discussion between the panellists and to answer questions from the audience.

Mr. Churchill stated that, "In the coming decades, most of the world's increase in energy use will come from the developing world. Under even modest growth scenarios, the combination of initial low per-capita consumption and growing populations will lead to dramatic increases in overall energy consumption. This has created a sense of alarm in many quarters where the concern is that this growth in energy production will create strains on both the local and global environment. Before the end of the decade, China, for example, will be bringing the equivalent of another 1000 Mw coal-fired plant on line every month. India will be close behind." He went on to note that even if Canada were able to eliminate all our carbon-dioxide emissions entirely by some technological magic as yet undiscovered, it would make no discernable difference to global carbon emission trends.

In his closing remarks, Mr. John Sheehan, acting in his capacity as a member of the Executive Committee of the Energy Council of Canada as well as a senior executive of B.C. Hydro, said that, "On behalf of B.C. Hydro, on behalf of CIDA and the other sponsors, we are very grateful for the attention the delegates brought to all of our sessions and particularly we want to thank those people who came from so far away to attend this Forum, and brought us the benefit of their views. Hopefully we will all go away a little bit richer than we were when we came last Sunday."

Official Opening and Introductory Remarks

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

John Sheehan is Vice-President, Environmental and Corporate Affairs, at B.C.Hydro. In that position he supervises environmental and corporate planning, policies, communication and management of the company's media, government and public affairs. Mr. Sheehan has also served as Vice-President of Petrosar Limited, Treasurer-Controller at Air Canada, Executive Vice-President and General Manager of Chromium Mining and Smelting Ltd., and Assistant Controller at George Weston Ltd. Mr. Sheehan is currently Chairman of the Canadian Electrical Association and a Director of both Holy Family Hospital and the B.C.-Yukon Division of Canadian National Institute for the Blind.

FIFTH ANNUAL ELECTRIC ENERGY FORUM

Official Opening and Introductory Remarks

Welcome and Introduction

I would like to call this opening session of Energy Forum '92 to order. I am John Sheehan and I am Vice-President of Environment and Corporate Affairs at B.C. Hydro. More particularly, I am your Chairman for this evening.

Now, to extend an official welcome from Victoria, I would ask Councillor Jan Greenwood, Deputy Mayor of Victoria, to please come to the podium.

Welcome by Councillor Jan Greenwood

I am very delighted and pleased to extend greetings to you all from the City Council of the City of Victoria and to welcome you to the Capital City region of Victoria. Those of you who are from British Columbia know that the city is only a small part of the urban area surrounding us here and that we are part of a regional district with 10 other municipalities. I hope while you are here you will have a chance to move a little bit farther away from the Conference Centre and the Inner Harbour.

For those of you who are from outside of British Columbia, from other parts of Canada, welcome, and a special welcome back to those of you from different parts of my home province of Alberta. Some of you I've met already. And any of you who are from outside of Canada, a very special welcome. I hope you'll come back and visit us again.

Like many cities, Victoria is aware of the need to continue to improve involvement with energy consumption and conservation. I was speaking to Mr. Sheehan a little while ago, and telling him how pleased we are that we in Victoria have been part of the B.C. Hydro Power Smart program for the last year and a half or so. We talked about the leadership that a city can give, together with a large corporation such as B.C. Hydro, in leading the way in electric energy conservation. I also want to recognize and acknowledge that our citizens are very concerned about resources and efficiency, conservation and the environment, and I see from the program that some of your workshops will be dealing with these issues and many other similar topics. The other part is that many citizens want to participate in protecting the environment and learning about the very difficult changes that may be necessary.

The big discussion in Victoria right now surrounds such things as waste management and how can we change our citizens' ways of dealing with our refuse. There is also the whole issue of transportation in the Victoria region and what kinds of alternatives we should be developing over the next few years as our population grows. We have to provide means for moving large numbers of people from our outlying areas into the city and also moving people around within the city without delays. So there are major discussions and arguments going on about, 'Shall we continue to drive our cars the way we have?' I think that similar discussions are probably going on for many of you from other cities in Canada and from other parts of the world.

Hopefully, this Forum will continue to provide an exchange of information about new technological changes that will help us all participate in these ongoing discussions from an informed viewpoint. I hope that you enjoy your stay and that you don't get blown off your feet by the wind during the rest of your stay here!

Response by John Sheehan: Thank you, Deputy Mayor Greenwood. Now, to bring greetings from the Province of British Columbia, I ask the Minister of Energy, Mines and Petroleum Resources, the Honourable Anne Edwards, to come forward.

Introductory Remarks by the Honourable Anne Edwards

On behalf of the Government of British Columbia, I would like to welcome you all here. I bring particular greetings from Premier Mike Harcourt and regrets and greetings from Moe Sihota, who is the Minister responsible for B.C. Hydro, and who had planned to be here, but found himself unable to attend.

I am particularly pleased this year that B.C. Hydro's 5th Annual Energy Forum has been combined with the 14th Regional Conference of the Energy Council of Canada. That will give it an added dimension, I believe. The Energy Council of Canada, or CANWEC as it was formerly known, last held its conference in British Columbia during 1984. I understand the 1984 Conference was a very successful and I hope that this year's will be equally successful.

I also would like to extend a particular greeting to our international friends. I understand that there are delegations here from Mexico, South America, Asia and perhaps other countries, and I certainly would like to give you a particular welcome. We are very happy to be able to have you here to exchange views and to get to know you just a little bit better.

I would also like to welcome the representatives of various environmental groups and consumer interest groups. These people have become regulars here. I know, because I've attended this Forum myself in previous years, and I know that they recognize a good thing when they see it and keep coming back. I certainly look forward to everyone's active participation in the workshops which I hope to be able to attend, and I certainly look forward to the results of the Forum and the results of your exchanges of views.

My Ministry has been a co-sponsor of this Forum ever since its inception. I know from my personal experience that the Forum provides a particular opportunity for you to discuss all aspects of energy. It's not just supply and demand that we are talking about here. We are talking about environmental impact; we are talking about resource utilization and about public attitudes. So go to it. I certainly wish you well and I hope this Forum proves to be a worthwhile and revitalizing experience for all of you. Thank you.

John Sheehan: Thank you, Minister. This Forum, Energy Forum '92, is a combined conference of the Energy Council of Canada and B.C. Hydro, and we have Mr. Scotty Cameron, the Chairman of the Energy Council with us. Scotty is the President and Chief Executive Officer of Pan-Alberta Gas Limited. He was formerly the General Manager of the Independent Petroleum Association of Canada, and served in a number of senior posts in the Saskatchewan government, including Deputy Minister of the Department of Industry and Commerce. He was recognized as the 1980 Member of the Year by the Calgary Chamber of Commerce. He currently serves as a Director of a number of organizations, including the University of Calgary, the Calgary Petroleum Club and the National Council for Canadian Unity. Please welcome Mr. Scotty Cameron to the podium.

Introductory Remarks by Scotty Cameron

As you are undoubtedly aware, the Energy Council of Canada, which I represent, was formerly designated as CANWEC, the Canadian Member Committee of the World Energy Council. We remain the Canadian participant in the 90-member-country World Energy Council, which is a non-governmental body dedicated to promoting the sustainable supply and use of energy for the greatest benefit of all. The World Energy Council (WEC) is preparing to hold its 15th World Congress in Madrid, in September of this year, addressing the broad theme of 'Energy and Life.' I anticipate that many of you here today will participate in that important congress; in its technical papers and round-tables and in the myriad committee activities.

In this regard, I would specially acknowledge the presence here today of Dr. John Foster, a distinguished Canadian who is President of that world body, and who has made an enormous contribution over some 20 years to its technical and administrative activities.

In addition, however, to the international activities of the Energy Council of Canada, we have a developing and growing domestic Canadian program, of which this Forum is one manifestation. Another has been the development of a position piece, entitled 'Towards a Common Energy Future,' which describes the energy policy options that lie ahead of us in Canada, and which constitutes Canadian input to the work of an international World Energy Council Commission on Energy for Tomorrow's World, which covers the full breadth of energy supply systems and end use applications. I would mention parenthetically how pleased we are to have Mr. Derek Davis with us, who is Executive Director of that prestigious WEC Commission, and who will address this Forum tomorrow morning.

A third aspect of our Canadian program has been the initiation of a Liaison Group with the major sectoral energy associations, such as the Gas Association, Electrical Association, etc.; these associations do a fine job of representing the concerns of their specialized memberships, but we believe that the Energy Council of Canada has a special role in providing a mechanism for *collective* discussion and action.

A unique feature of the present Forum lies in the participation of over 30 delegates from overseas, through the good offices of CIDA (the Canadian International Development Agency) and industrial co-sponsors, under our Energy Council sponsorship. These delegates will participate in the Forum over the next two days, and will hold a special session on Wednesday morning on 'Technology Transfer in Developing Countries.' I would encourage the Canadian delegates to individually meet with and welcome these distinguished visitors. I would also mention that we are honoured to have a very senior representative from the People's Republic of China with us, in the person of Vice-Minister **Hu Fuguo**, who has senior responsibilities for the Coal Industry in China.

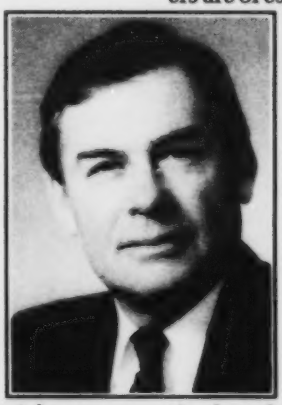
Before leaving the podium, I would like to take the opportunity to express the Energy Council of Canada's appreciation of the diligence of B.C. Hydro, in undertaking so ably the organizational and operational logistics of 'Energy Forum '92.' It is great to

simultaneously participate in the 14th Canadian National Energy Forum, and the Fifth B.C. Hydro Electric Energy Forum. I would especially acknowledge the leadership of Bob Wyman, Ray Hunt and John Sheehan in making this happen. I would equally acknowledge the valued participation of the co-sponsors in British Columbia – the Ministry of Energy, Mines and Petroleum Resources, and the Ministry of the Environment, Land and Parks.

Finally, a word of welcome to you, the delegates, who are here to help us understand the three intertwined themes of 'Efficiency, Trade and the Environment' within the overall Energy framework. I think that you will find the program demanding, but I think you will also find it extremely rewarding, and so I bid a very warm welcome to you all.

John Sheehan: Thank you, Scotty. Now, the last of our welcomers this evening, but by no means least, we have the Chairman and Chief Executive Officer of B.C. Hydro, Mr. Bob Wyman. Prior to joining B.C. Hydro, he was Chairman of Pemberton securities Inc. He also worked for Richardson Securities of Canada, Hall Security Ltd. and Canada Life Assurance. Mr. Wyman serves as Chairman of the UBC Capital Campaign, Senior Member of the Conference Board, and Governor of both the Business Council of B.C. and the Downtown Association. He is a Director of the B.C. Telephone Company, Finning Ltd. and Suncor, Inc. He has participated in a great number of public service and business activities, ranging from Chairman of the Vancouver Board of Trade to Director of Sunny Hill Hospital for Children. He has also served as Chancellor of the University of British Columbia.

Official Opening by Bob Wyman



On behalf of B.C. Hydro and our co-sponsors, I would like to welcome all of you to this, our Fifth Annual Electric Energy Forum. The forum this year is being held in conjunction with the 14th Regional Annual Forum of the Energy Council of Canada and we, at B.C. Hydro, are pleased to be the host utility for the Council's regional forum.

I would like to extend a special welcome to the group sponsored by CIDA, the Canadian International Development Agency. As mentioned earlier, this group includes representatives from several differ-ent countries. I would also like to give special recognition to the Vice-Minister of Energy for the People's Republic of China, Mr. **Hu Fuguo**.

I am pleased that the Minister of Energy, Mines and Petroleum resources for the Province of British Columbia, the Honourable Anne Edwards, was able to join us this evening and to officiate at these opening ceremonies. The Minister has also graciously agreed to be our luncheon speaker on Tuesday and to take part in our panel discussions that afternoon. As many of you will recall the Minister has attended these forums in the past as energy critic for the official opposition and we would like to congratulate her on her appointment last fall to her present important role in our provincial government.

I would also like to thank Councillor Jan Greenwood, the Deputy Mayor of our gracious and beautiful host City of Victoria, for joining us tonight and for her opening words of welcome.

Now, I am not going to make a long speech but I would like to add a few words about these Forums and the feelings that we at B.C. Hydro have about them. For B.C. Hydro it is important that our decision-making reflects public values and this annual Energy Forum has become, over its relatively short life, one of our major instruments for public involvement and participation. We have built upon the experience of the previous four Forums in developing this year's format for the discussion groups, which make a significant contribution to the success of the forums.

Other adjustments that we have introduced into this year's program are also in response to ideas that we have received from previous year's participants or from other interested members of the public. Some of the ideas from last year's forum have also been taken into account in our business planning, as you will note when our next Corporate Business Plan is issued.

For this year's Forum, I am excited by the excellent speakers that we have managed to attract. These speakers are of especially high calibre and they are experts on a variety of relevant topics as you will see from your programs. A large part of the success of these Forums has been the support of our co-sponsors and I would like to thank this year's co-sponsors: first our sister utility, West Kootenay Power. I would also like to thank the Provincial Ministries of Environment and Energy, Mines and Petroleum Resources and Environment, Land and Parks, and finally our subsidiaries Power Smart Inc. and POWEREX, and our joint venture, PowerServ Inc.

Finally, I hope you will all find these sessions not only educational and productive but also enjoyable.

Thank you very much, ladies and gentlemen.

John Sheehan: Thank you, Mr. Wyman. Now, please join us at the no-host reception, which will be held upstairs in Salon A, immediately.

This Session is now adjourned.

Energy in a Global Context

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

John Foster is President of the World Energy Council and a past Chairman of the Canadian National Committee. He has held several posts, including President, with Atomic Energy of Canada Ltd. (AECL). Dr. Foster was a member of the Nuclear Power Group which produced the feasibility study on the Nuclear Power Demonstration Station, Canada's first nuclear-electric generating station. He also worked for Canadian General Electric. Dr. Foster holds honorary doctorates of engineering from the Technical University of Nova Scotia and Carleton University. He is a Fellow of the Royal Society of Canada, the Canadian Academy of Engineering, and the Engineering Institute of Canada, which bestowed on him the Julian Smith Medal. He was appointed by the Lieutenant-Governor to the Council of the Association of Professional Engineers of Ontario, and is an Honorary Director and Past Chairman of the Canadian Nuclear Assocation, which awarded him the W.B. Lewis Medal.

Opening Remarks

Dr. John S. Foster

President, World Energy Council

It is a great pleasure to be here and bring you greetings from the World Energy Council. There is something rather fitting about the nature of this Forum, combining as it does the 14th Canadian National Energy Forum and B.C. Hydro's Fifth Annual Electric Energy Forum. The World Energy Council had its origins in the First World Power Conference held in London in 1924. Canada was one of the 24 participating countries and is a charter member of the Council. Predecessors of B.C. Hydro were part of that original Canadian group. Ever since that time, the Canadian member committee of the World Energy Council, now called the Energy Council of Canada, has played a constructive role in the world body, and B.C. Hydro has done the same within the Canadian committee.

Several here will have attended the World Energy Council's last very successful Congress in Montreal. Some may recall our International Executive Council meeting in Banff in 1978, also a credit to your Canadian Committee. After the Congress, some of the Study Tour delegates came to British Columbia. I was not fortunate enough to be on one of those, but I heard glowing reports afterwards. I was, however, here on a tour that followed the 1978 meeting. B.C. Hydro were our hosts and looked after us extremely cordially and efficiently. We visited the coal port at Roberts Bank, the HVDC terminal, the dining room of the Capilano Golf Course and other important energy facilities. It was an extremely interesting and enjoyable visit.

On behalf of the Council, I should like to express our gratitude to the Canadian Committee, to B.C. Hydro and to the other energy organizations in this part of the world that have played such an important role in energy development and who have contributed so generously down the years to the work of the World Energy Council.

The theme of this Forum is "Efficiency, Trade and Environment" — three very important aspects in relation to the development and use of energy.

The choice of Efficiency is indicative of the recently heightened concern about some of the consequences of our use of energy.

In recent years, there has been a growing feeling that decisions on energy supply and utilization have not taken into account some relevant and very important factors. Hence, the interest in employing higher efficiencies than those that fall out of the usual optimization calculations.

In the 1970s, of chief concern was the depletion of resources, particularly oil resources. OPEC did its best to address this by attaching higher prices to these resources. However, this happened to coincide with and aggravated the onset of a period of universal inflation and eventual recession, and the new prices didn't endure. Nevertheless, the resulting excitement did lead to new interest in higher efficiencies in industry and transportation and a revived conservation ethic. This has resulted in a sustained flatness in oil demand and an unjustified relaxation of the concern about depletion of oil and, for that matter, gas.

The popular concern of the late 1980s and early 1990s is the 'Greenhouse Effect.' Knowledge of the possibility of enhanced Greenhouse Effect has been with us for a century but, rather disconcertingly, from about 1940 to the early 1970s, global temperatures declined while man-made greenhouse gas emissions increased. Fortunately, global temperatures have turned upward again; things are unfolding as they're supposed to and we can now re-shoulder our concerns with greater confidence.

Two of our speakers this morning are going to address these matters. John Hollins of Environment Canada is going to speak on 'Environmental Constraints on the Energy System' and David Scott, from the Institute of Integrated Energy Systems here in Victoria will speak on 'The Architecture of Our Evolving Energy System,' which will involve the subject of Efficiency and how energy supply and utilization will tend to be organized to make best use of the available resources with the least adverse side-effects.

But first, we will listen to the Keynote Address by Derek Davis, on the subject of 'Changing Patterns of Energy Trade.'

Keynote Address: Changing Patterns of Energy Trade

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Keynote Address

Changing Patterns of Energy Trade

Derek Davis

Executive Director, World Energy Council Commission

Introduction of Derek Davis by John Foster

The Keynote Address, by Derek Davis, has the timely topic of 'Changing Patterns of Energy Trade'. This is an extremely important subject for this country which has a large, relatively balanced trade in petroleum and petroleum products, exports one-third of its gas production, a large amount of coal, as much as 10 percent of its electricity, and has exported, or is committed to export uranium with more potential energy than is available in all the country's oil, gas, coal, and tar-sands resources combined, not to mention the energy contained in the country's agricultural, forestry and mineral exports.

Derek Davis is particularly well-qualified to speak on world energy trade. He is a former Executive Director of the Central Electricity Generating Board of England. Previously, he held a number of posts with the Board, including Director of Corporate Strategy, Director of Production and System Planning Engineer. Mr. Davis' early career was spent in the aircraft industry on the development of gas turbine and rocket engines for military use. Shortly after his retirement, the government privatized the utility. For several years, he travelled the world as Chairman of the joint WEC-UNIPEDE International Committee on Power Plant Availability. He is now Executive Director of our Commission on Energy for Tomorrow's World, which is a major review of world energy prospects in the light of the new concerns with efficiency and the environment. Mr. Davis also serves as a member of both the Science and Engineering Research Committee and the Meteorological Committee.

Please join with me in welcoming Derek Davis.

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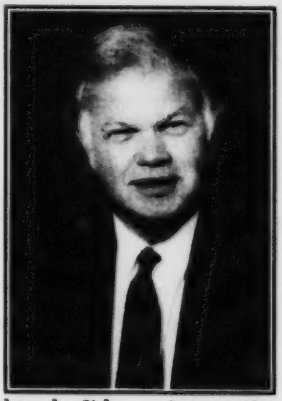
1. Introduction

Thank you, John, for that kind introduction. Ladies and gentlemen, you do me a very great honour, indeed, to invite me to lead off in this auspicious Forum.



The subject areas that you will be covering in this program are very dear to my heart: global energy, efficiency, the environment – and then on Wednesday, technology transfer. And these are also key areas of interest for the World Energy Council Commission to which John Foster has just made reference.

Whilst I will say a little bit about world trade, I'd like to broaden out a bit and talk about some of the concerns on the totality of the world energy scene. I realize that quite a lot of you will know nothing whatsoever about the World Energy Council Commission, and maybe nothing about the World Energy Council (WEC), when it comes to it.

I'd better say just one or two things about the Commission itself. The objective is to try and identify, in the longer term, the priorities for the energy industry across the globe in the context of the many conflicting priorities and constraints within which we find ourselves, and to identify pathways into the future. It's a bottom-up, top-down process. What we have done has been to set up nine disciplinary regional groups covering the whole world, all reporting using common guidelines, derived centrally. And they, together with a single global report based upon them and on other special studies which we've specifically commissioned, will be presented to the Madrid Congress in September of this year and will then form the basis of our final report around the spring of 1993.

The whole work is overseen by an international multi-disciplinary and high-level commission board of about 40 persons, each eminent in the energy field, but I wish also to stress their expertise in other related fields. I hope it will be possible for many of you to come to Madrid to debate what we have put together. It will inevitably prove to be wrong, and hopefully, you will come along and argue with it and say where it should be put right.

Now, I have an old aunt in the east end of London who lives up on the first floor of a flat, and downstairs on the ground floor of the flat there's a parrot in a cage. It's an intelligent parrot, and one day, when the old lady

was sleeping upstairs, the milkman came and knocked on the door. The parrot said, "Who's that?" The milkman said, "It's the milkman", and the parrot said, "Who's that?" again and the milkman said, for the second time, "It's the milkman." And the parrot repeated, "Who's that?" and the milkman said, – well, this went on for a long time and, ultimately, the exasperated milkman expired of a heart attack on the front doorstep. Finally, the old lady, hearing all this commotion, staggered downstairs, brushed past the parrot, opened the door, there was the recumbent form of the milkman on the front step and the old lady said, "Who's that?" The parrot said, "It's the milkman."

Which is a story that suggests to me that if you say something often enough, ultimately it will sink in. I think what I have to say has been said often enough, but I've yet to determine whether it has sunk in or not.

The basic problem with energy is the same as the basic problem with food. We have plenty of it now and are likely to have plenty of it in the future but the distribution is faulty. The pattern of supply does not match the pattern of demand and many who have enough, waste an awful lot of it. And as with food, the situation would be immeasurably worse without trade in the commodity. But, continuing with the analogy, trade is not the whole solution to the problem of energy poverty any more than it is the solution to the problem of hunger.

People need to be able to buy food and energy but they also have to be able to grow their own food and they have to be able to provide their own energy, particularly if they cannot afford to buy it. And the challenge to the global energy industry in 1992, looking ahead to and through the first half of the next century, is to provide energy through trade, yes; but also to enable energy to be indigenously provided through technology and through education and to cause it to be used efficiently, safely and harmlessly. And that is trade as well, but of a different nature.

So we cannot look at patterns of trade without examining not only patterns of supply and demand but also underlying factors which influence those patterns, such as economic growth, finance, indigenous technology and technology transfer, energy efficiency and conservation, self-sufficiency and interdependence, and the uncertainties which inevitably surround all these. But of course, both food and energy are only a means to an end, pleasurable though the former may be in the process. Each is a service, essential to the quality of life: energy must be seen ultimately, or from the beginning indeed, as heat, warmth, light, motion, communication, or whatever.

Later on this morning, David Scott will be talking about the evolving energy system: I don't know in detail what he's going to say but it's enough for me to hear the word **system** to endorse the perception that you cannot safely pick out one limited area of the energy business and deal with it on its own. You **have** to start at the end and work back to consider all the inter-relationships, and if you are wise, you will not reach hard conclusions until you have done so. So energy trade starts from peoples' needs and aspirations and those are at the end of the cycle. At the other end of the cycle, at the beginning of it, are energy reserves, and in spite of what I just said, I am going to start at the beginning.

2. Patterns in Primary Energy

2.1. Current Energy Movements

I'd like to illustrate these points with some slides. **Figure 1** shows the distribution, or rather the maldistribution, of fossil fuel reserves across the globe. The total pattern is, in fact, rather more evenly spread than one might have thought. The real problem is that oil, coal and gas, each of which have different end-use applications, **are** very unevenly distributed.

Figure 2 shows the balance of production and use on a regional basis, from which the pattern of world trade and energy derives. The Middle East accounted for some 60 per cent of total oil movements in 1990 and North and West Africa a further 20 per cent. As with oil, so with coal and gas: two or three different regions dominate. The USSR, as it was, was responsible for 47 per cent of total natural gas exports. North America and Australasia were responsible for most of the coal exports, albeit on a much smaller scale.

Compared with oil, it is remarkable how well-balanced coal production and use is across the world; hence, the small volume of global coal trade. In 1990, world trade in oil represented just under 50 per cent of consumption, whereas world trade in coal represented less than 10 per cent of consumption. Thus in 1990, just over 30 per cent of fossil fuel-based energy was traded across borders, oil being the dominant component in that 30 per cent figure. That 30 per cent represented on a monetary basis about nine per cent of the value of world trade as a whole.

It's interesting to note that trade in food also represented about 9 per cent of the whole of world trade, which only goes to show how dependent we are on each other and how important, of course, these two commodities are to our well-being. The important bit, of course, is how the energy trade figure is likely to change over the long term, and I will review that in due course.

2.2. Determining Factors

These movements of fossil fuels across the globe result from the quality of life that people seek, their perception of the contribution that energy must make in achieving it, the pattern of energy reserves, the ability of people to find and exploit them and where the people are, and the historic pattern of their economic growth and how efficiently they are able to use the energy they

can lay their hands on; a multitude of different factors. The resulting characteristic of all these factors is not dissimilar to that of energy reserves; namely, there is a palpable unevenness of distribution between nations.

Figure 3 shows the pattern of inequality on a per capita basis, region by region. Some 70 per cent of the world's population exists on less than 40 gigajoules per capita, while five per cent of us enjoy six times that figure.

In summarizing the world energy trade, the countries of the world may be categorized in terms of how rich or poor they are in resources, how rich or poor they are in quality of life, in energy use, and what role they play in energy trade. This simple categorization is presented in **Figure 4** as a matrix showing the number of people involved in the base year 1990. Across the top, the columns are the industrialized countries, countries with economies in transition; two categories of developing countries, and the population at the far right. Down the left-hand side, the rows of the matrix are energy-rich exporters, energy-rich importers, energy-poor importers, population in millions and the population expressed as a percentage of the total.

I find this to be a particularly interesting matrix. It's based on our own breakdown of population and value judgments, and it's to be taken as indicative only. But it does indicate some interesting aspects of global life and energy. For instance, in numerical terms, there are rather more importers than exporters, 57 per cent versus 43 per cent. As of now, roughly a quarter of the population is entirely dependent on imported energy, with no resources at all other than some minor traditional fuels. The industrialized countries who use over 45 per cent of the energy have 16 per cent of the population. The pattern of world trade in energy will change as the fortunes of the countries categorized in this matrix change, and those fortunes are not determined entirely by people's own volition. The important factors are the same as listed earlier. We need to examine them one by one, plus a few others, to see where we might be going.

3. Looking to 2020

3.1. Total Energy Demand

At the Montreal Congress, as some of you may know, the WEC published estimates for world energy consumption and primary energy supply through to 2020, under the title 'World Energy Horizons.' The estimates were broken down into five regions of the world. In conjunction with Jean-Romaine Frisch, who was the coordinator of that work, the Commission has revisited those figures, recast them to reflect the eight regions of our own studies, and examined variants to the reference projection so derived.

We have used these as the necessary supporting data for the Commission's central work, the examination of the priorities and the strategies needed to tackle the problems we face. The conclusions we reach give no reason to rest on our laurels, unless we are classical isolationists. For instance:

Whilst there is likely to be no shortage of primary energy as such into the next century, and whilst total world energy demand is likely to continue inexorably to rise, the prospects for the majority of the world's population, in terms of increasing the availability of energy per capita, look very bleak.

I'll talk about the uncertainty in a minute, but failing some miracle or other, the problem seems inevitable: energy production does not seem likely to keep up with population growth, however much we try and trade it. Let me take these statements one at a time. First, we have made fairly modest assumptions about rates of economic growth across the regions. These are summarized in **Figure 5**. We have shown the economic growth rates, broken down in OECD, Central East Europe and the Sovereign States of the territories of the former USSR, (shown as CEE+SS), and the developing countries (DC).

You'll see that for the period 1990 to 2020 we are modest about OECD compared with history, 2.4 per cent per annum from 1990 to 2020, compared to 3 per cent from 1970 to 1990. I think we are realistic about the prospects for the Central East Europe and the Ex-USSR states. Here we've assumed 3.6 per cent 1990 to 2020, compared with 1 per cent per annum from 1970 to 1990. Of course that higher figure reflects our expectation of growth as they emerge from their centralist regime. And for the developing countries, 3.4 per cent per annum growth in future, compared with 3.5 per cent over recent history.

Second, we have taken a look at expected per capita energy intensities. **Figure 6** shows the historical movements and our assumptions for the future. They are fairly optimistic, I think. They imply continued progress in energy efficiencies across the board in both use and provision; this is, in fact, a reversal of the trend for both the central European states and for the developing countries, and remains much the same as before for the OECD countries. I recognize that in talking about energy ratios we are talking about very much more than energy efficiency; we are talking about the role of energy in our way of life. We in the developed countries must not assume that developing countries will wish – or should wish – to achieve their aspirations for quality of life in the same way as we seek to achieve ours. There are other ways of ensuring that you have fresh milk besides running a refrigerator. Keeping a cow, for instance.

There are all sorts of perceptions as to how things look to different people. Incidentally, that reminds me of a story of a group of hikers in the English country-side who had not only gotten lost but had also lost track of the time. They came into a field and at the other side of the field there was a farmer, a wizened old man standing beside an immense bull. And I hope the ladies will

excuse the following slightly coarse country language or practice, but it seems that the leader of the party went up to the farmer and said, "Excuse me, my man, I wonder could you tell me the time?" The farmer stared at him for a moment and he turned around to the bull and lifted the bull's testicles with his right hand. As he did this, he turned to the leader of the party and he said, "Its five minutes past twelve." The hiker was slightly taken aback, but said, "Thank you very much." and went off. In the corner of this field was another hiker who was equally lost but still had his watch. And he was intrigued by this practice and so he went up to the farmer, slightly wary so close to this immense bull, and asked the farmer, "Ah, excuse me, sir, could you tell me the time?" The farmer did the same thing, and after some deliberation replied, " It's now about seven minutes past 12 o'clock." The hiker checked his watch and found that the farmer's time was accurate. He was amazed, and said to the farmer, "Thank you very much, indeed. But I wonder, could you tell me how on earth that you tell the time by doing that to the bull?" The farmer said, "Oh, it's got nothing to do with him at all. If I lift his balls a bit, I can read the clock on the church steeple down in the valley." Which is a story which suggests to me that you do have different ways of doing different things and people don't always actually know what you are doing.

I hope you now have some idea of what we're doing in this study. You might say that what we are actually trying to do is to see the church clock.

These assumptions give a total energy demand in 2020 of 13,100 million tonnes oil equivalent for the reference case. That's a growth of about 1.4 per cent per annum through to 2020 compared with an historic growth figure for the world over the last 30 years of 3.2 per cent per annum, and of 2.2 per cent per annum over the past ten years. So it's a modest growth.

Of course, you can play all sorts of games with these figures and we have done that with them, but what is important is that when you look at the population growth, you see the size of the task ahead in providing energy for everyone. **Figure 7** shows the United Nations' world population projections from 1990 to 2020, which we have adapted to our regional breakdown. They estimate a 144 per cent population growth in sub-Sahara Africa by 2020, a 66 per cent growth in South Asia, 51 per cent in the Pacific and a 28 percent growth in China. **Figure 8** shows these population data in absolute terms: 700 million in sub-Saharan Africa alone. The net result is that in these critical low energy use areas of the world, the per capita consumption remains virtually unchanged from 1990, although of course the absolute consumption rises immensely.

If, as an energy exporter, you are hard-headed about this, it's all good news because the imbalance between indigenous supply and demand is likely to be accentuated with growth, particularly by a lop-sided growth in demand. **Figure 9** shows the pattern of demand for our reference case in the year 2020. This demand, just to be perverse, is plotted together with the 1990 supply pattern of Figure 2. It shows the very accentuated demand/supply imbalance that would result if the production pattern of 1990 is unchanged, which is obviously an unrealistic assumption. Charts like this are very sensitive to what actually happens in the developing world, as illustrated in **Figure 10**. This figure simply says that if you double the per capita consumption in the developing world, and allow a very modest rise for the rest of the developed world, the total energy demand will increase by some 50 per cent. Virtually all of that increase would be in Latin America, Africa and Asia-Pacific.

These convolutions bring me back to the pattern of energy flow matrix shown earlier in Figure 4 for the year 1990. Here, in **Figure 11**, it is redrawn for the year 2020. The changes are dramatic. Because of indigenous demand growth, energy-rich exporters become energy-rich importers. In population percentage terms, the energy-rich exporters fall from 43 to 12 per cent of world population and the energy-rich importers rise from 33 to 42 per cent. Energy-poor importers increase from 24 to 46 per cent. The world is already a shrinking globe. We are growing into dependence and tighter cooperation out of necessity, driven as much out of necessity as out of brotherly love. The prognosis is that we are only at the beginning of the shrinkage: that the 1990 figures of 30 per cent energy traded is likely to be nearer 50 per cent by 2020. The question for some is not whether there will be enough energy but will we be able to buy it; and who will call the global energy tune? The question for the majority remains, "Will we ever have enough?"

3.2. Patterns and Dilemma

Now, ladies and gentlemen, when we come to examine the pattern of primary energy sources that will make up the necessary increase in production to meet demand growth over the next decade, we find something of a paradox. **Figure 12** shows the share of the total energy cake held by the various primary energy sources. It shows remarkably little change over the 30 years from 1990 to 2020. Fossil fuels continue to dominate in spite of some hopeful signs and assumptions in regerd to hydro, nuclear and new renewables, as shown in **Figure 13**. The volume increase in fossil sources (total of the first three columns) is up some 3.3 billion tonnes oil equivalent, to 9.8 billion tonnes oil equivalent. Of that, over 60 per cent will be used by the developing nations. With the exception of the two developing countries with high GNP per capita, the remainder are increasingly dependent on commercial fossil fuels as demand, with population, increases and as traditional sources, on which at present some 20 per cent of the world's population depends, are depleted.

In the Commission studies, the regions have confirmed that the immediate priority for the **developing**

world is the unavailability of commercial energy to a majority of the population. They also confirm the need for efficient use and provision of energy, the need for environmental concern and action locally and the need for appropriate technology transfer. They do not see global warming as a priority for them; solving the energy poverty problem will be pursued regardless of global effects. Those are the hard facts as they perceive them.

The developed world, of course, recognizes the priorities above plus the need to take what action it can to counter the global warming threat. But the fuel mixes postulated in the regional reports are not obviously constructed in an overt drive to counter global warming. They are reactive to market forces as presently understood to meet demand in the context of cost effective efficiency, conservation and environmental measures.

The impact of all this is that, in spite of the significant and continuing improvement in energy efficiencies and conservation we assume in our studies, the trend of CO_2 emissions is predictable; it will continue upwards. **Figure 14** shows our conclusion from the fuel mix in the reference case, broken down by regions, showing the changes that emerged from 1990 to 2020. **Figure 15** shows the global summary. For the global 'high case,' which is dominated by energy growth in developing countries, and thus implies increases from predominately fossil fuel sources, carbon emissions increase by 100 percent in the 30-year period to 2020.

So I have two depressing stories, really. One is the problem of energy supply to a large number of people and second is the reality of CO_2 growth. This conclusion underlines the strategic dilemma in which the world finds itself. Economic growth in the developing countries is vital to alleviate poverty suffered by millions: yet a vital component in achieving that growth – the use of more energy – puts the world under greater threat through global warming unless measures of very great effectiveness can be implemented to limit CO_2 emissions.

What is certain is that, as seen from today, the greenhouse threat remains and fossil fuels will remain the primary source of energy under currently perceived conditions.

And what do we do in that situation? The ultimate end-point, of course, is that fossil fuels, especially oil and gas, will deplete towards the end of the century and the world will, by then, be introducing replacements which are currently seen to be renewables and nuclear, but which by then may well include hydrogen as a secondary source.

That's the end-point. In the first half of the century it is certain too that, as I've said, given the likely primary energy mix that develops and even given the very significant changes in energy use and substantial improvements in efficiency and energy conservation; CO_2 levels will still continue to rise from now and could be two or three or even four times present levels by 2050. That may sound like a prediction of doom and gloom but I think one has to look the facts in the face. If, and it's a big if, the global warming threat turns out to be real, how quickly could the world redeem the result of the fossil pathway it looks as if it will be pursuing over the first two or three decades of the 21st Century? The answer is slowly and probably much too slowly.

Diversity in primary energy sources between fossil and non-fossil fuels is therefore a highly desirable objective, both in regard to security of supply and also because it does not seem to me that we are likely to meet the threat of global warming adequately enough solely by other measures we could adopt. There's one further, longer-term argument. As time goes on, developing countries will be increasingly vulnerable to the impact of rising fossil prices as a result of depleting reserves. From their viewpoint, early diversification from fossil fuels to a broadened primary energy base on the part of the developed countries would be of longer term benefit in delaying effects of fossil resource depletion on price.

Whilst the developing world must seek conservation, energy efficiency and CO_2-clean technologies as far as they can, the developed world has to carry the brunt of the burden of achieving diversity, as of now through renewable energy sources and nuclear, particularly the latter, because they have the technology and the investment capability. The trouble is that, with one or two notable exceptions, they appear to have neither the political will nor the public sympathy. In several cases they don't have the right regulatory or fiscal framework either. Nor, indeed, do they have the necessary vision of the totality of the world's energy system, its complex but identifiable inter-relationships, and therefore, the drive to break out of the nationally introverted "You do your thing and I'll do mine" attitude and approach to world energy strategy.

I applaud the response of the world's governments to the global warming threat simply because it's unique. They are apparently prepared to take action in regard to something that is both uncertain in its reality and, if it is real, will in any case not come to pass for 20 or 30 years. **I cannot but muse, however, as to what progress would have been made in regard to the international problem of energy poverty across the globe had the same effort been applied to it as has been applied through the UNCED process to global warming, culminating in the Rio conference a few weeks hence.**

The same comment also applies to primary energy mix. Government tends to assume that energy problems and technologies required to meet the problems of energy mix always will sort themselves out, one by one, under the action of normal market forces as apparently they have done. There's no energy shortage as such

because of these forces, nor is there lack of exploitive technology for the same reason. However, that is not to say this will always be so, that no circumstances will ever arise in which the market is caught out with too little, too late. Nor is it self-evident that the market, unassisted, provides the best solution to everything, or solutions which provide the greatest good for the greatest number. Neither the market nor government are either omniscient or omnipotent, though representatives of each, from time to time, seek to give us the impression that they are. We need the right balance between the two. So we can legitimately ask, at least on this narrower front, whether some individual or collective action by national governments on energy mix to parallel that which they contemplate on the world environment might not be justified. We will have to move to non-fossil sources sooner or later. What we must have is the right reconciliation between the two elements which drive our energy policy.

Protocols, it seems to me, are not likely to eliminate CO_2 without diversification of primary energy sources, and I do not believe the market will do that rapidly enough in today's regulatory and attitudinal climate. There must be a government willingness to promote a climate that will encourage the rapid deployment of nuclear technology in the developed world and renew-able technology in both the developed and developing worlds in order to add the primary fuel mix element to the efficiency and conservation strategies already broadly accepted across the world.

I am not advocating direct subsidies. Carbon taxes may have their place, but I doubt whether taxes of sufficiently Draconian size would ever be politically acceptable. The impact would be too direct for such a speculative cause. Rather, the right conducive environment has to be created in a way in which the cost is less overt as far as the electorate are concerned. I advocate for nuclear energy, for instance, overt global cooperation on safety criteria and regulations; on commonality of design; on the fuel cycle including waste disposal; on institutional reform to ease the consent and licensing process. Equivalent measures should be initiated as appropriate for renewable resources. All the signs now are that, in contrast to the 1960s, the scales are weighed heavily against non-fossil exploitation just at a time when we cannot afford that to be so.

Finally, before half of you walk out, let me stress that this is not an anti-coal, oil and gas campaign. Not at all. The world cannot exist through the next century and beyond without their exploitation. I am talking about the rate at which these sources should be used and not about leaving any of them in the ground forever; about prudent policies in the light of present knowledge and uncertainty; not about final and forever decisions but about the pressing need to look at these problems as part of a totality and not in meaningless isolation.

4. What About Changing Patterns of Energy Trade?

I have outlined earlier the conclusion we in the Commission have reached on the generic changes in energy sinks and sources. I have described in the last few paragraphs the reservations I have on the continuing dominance of fossil fuels and the need, I believe, for governments to promote a more advantageous atmosphere for the exploitation of non-fossil alternatives. The implication for trade is that there should be a progressive shift of the centre of gravity of fossil energy movements towards the developing countries accompanied by a commensurate increase rise in trading technology. Trading with fuel is, of course, over the long-time frame: trading with technology is urgent.

4.1. Corporate Technology Transfer

Much has been said and written on technology transfer and there is always the danger of simply repeating old hat. We are clear however, that old hat or not, the effective framework for technology transfer must be based on the market system and that, for it to be successful, it must take place as a fair and balanced transaction between a motivated and informed technology buyer/receiver and a motivated, informed supplier/donor. But the right climate must be created as a catalyst for success; and that must be the job of government and of the relevant institutions.

In our report to the Madrid Congress we shall be saying that the most pressing need is to alleviate poverty and that the only way to achieve that is by massive investment: and that can only be achieved by tapping the resources of the private sector. It follows that we shall therefore be saying a fair amount about institutions. Suffice it to say here that we have found the clue, not only to investment but also to the many problems in developed and developing countries alike, lies in institutional deficiencies of one form or another.

As far as developing countries are concerned, reform of institutional arrangements seems to be the key to so much that is needed: investor confidence; incentives to induce efficiency; commercial pricing; equity participation and joint ventures; the transfer of complete packages including training, know-how, financing, managerial, technical and governmental assistance, etc., Trade in technology must be based on mutual confidence, not least because it must include not simply hardware but appropriate training for continued effective operation and maintenance of the technology. That means peoples' hearts and minds as well as their money.

5. Conclusion

On reading through this paper, I conclude that you won't have gained much information about trading patterns in detail, other than some very broad indicators. I do hope, however, that I have been able to convey the message which has become very clear to us in the Commission Project Management Unit involved with global energy, on a day-to-day basis, over the last 18

months or so. It is that the real and lasting problems of energy use and supply are not technical ones but are to be found in the way in which world society understands problems and reacts to them. The use and provision of energy is part of a complex and tangled system of human activity within which energy trade, be it in fuel, goods or in technology, is a vital element. That trade can only work as business: it won't work as a piece of altruistic goodwill. On the other hand, it's my view that it is incumbent upon all of us in the energy business at least to recognize the different and varied priorities, imperatives and constraints against which the countries of the world work: and that those are all to be exercised within the framework of the totality of the energy system as a whole. That system is itself part of the integrated social life of the planet. If we can bend our collective minds to that, we stand a far better chance of reaching a balanced judgment on the best way ahead for everybody.

Thank you very much.

Thanks by John Foster: Well, thank you very much, Derek. That was an excellent review and certainly sets the stage for our next speaker. I might also say there must have been a certain amount of contingency planning in your presentation, because you finished in very good time. But before I call on the next speaker, I would just remark that there will be an opportunity for discussion at the end of this morning's session, so if you have questions for Derek or any of the later speakers and panellists, please begin formulating them.

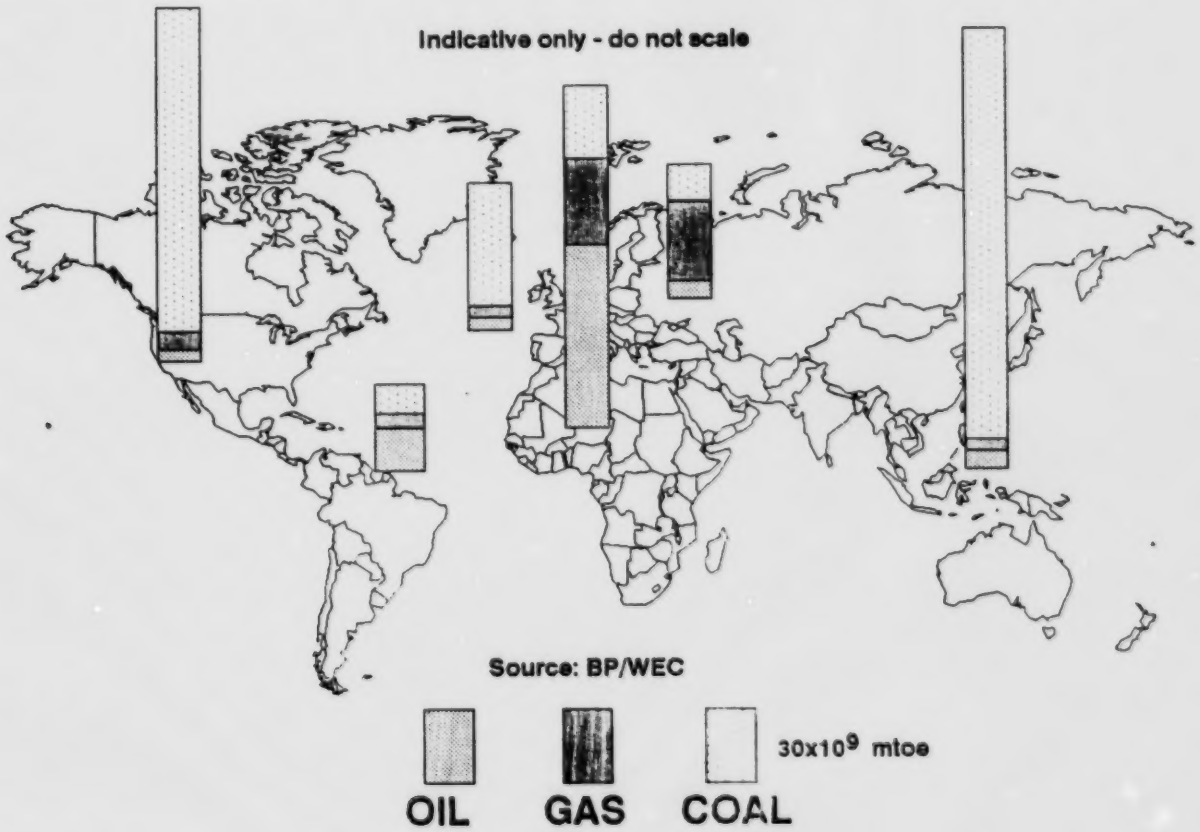


Figure 1: World Fossil Fuel Reserves

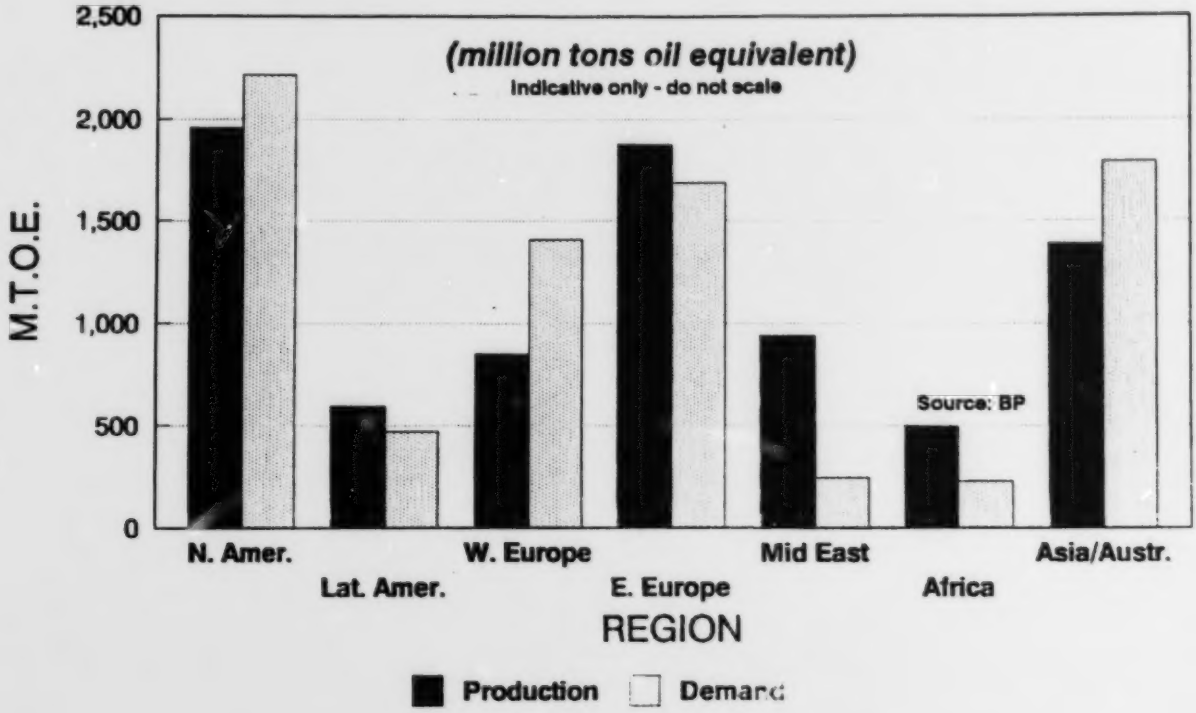


Figure 2: Patterns of Energy Production and Use, 1990

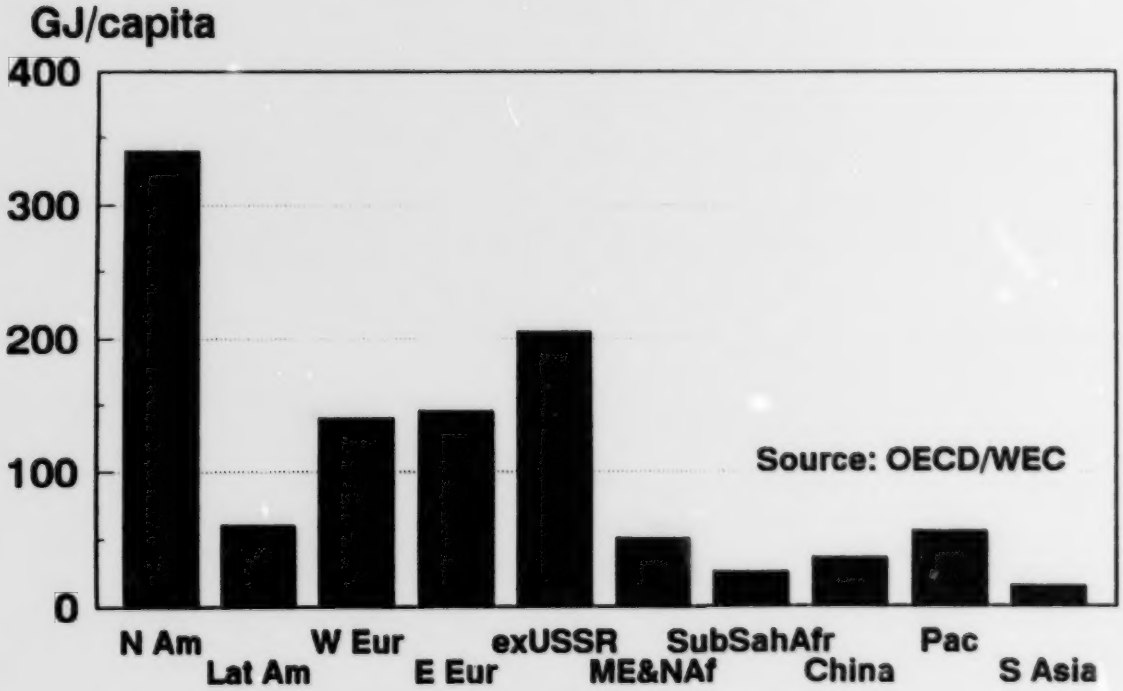


Figure 3: Regional Energy Use Per Capita, 1990

	INDUSTRIALISED COUNTRIES	ECONOMIES in TRANSITION	DEVELOPING COUNTRIES High GNP per Capita	DEVELOPING COUNTRIES Low GNP per Capita	POPULATION Million (%)
	Population - mn	Population - mn	Population - mn	Population - mn	Population - mn
En'y Rich Exporters	100	300	350	1450	2200 (43%)
En'y Rich Importers	350	50	200	1100	1700 (33%)
En'y Poor Importers	350	50	250	550	1200 (24%)
Population - million	800	400	800	3100	5100 (100)
Population - % total	16%	8%	16%	60%	Source: WEC

Figure 4: Patterns of Energy Flow in 1990

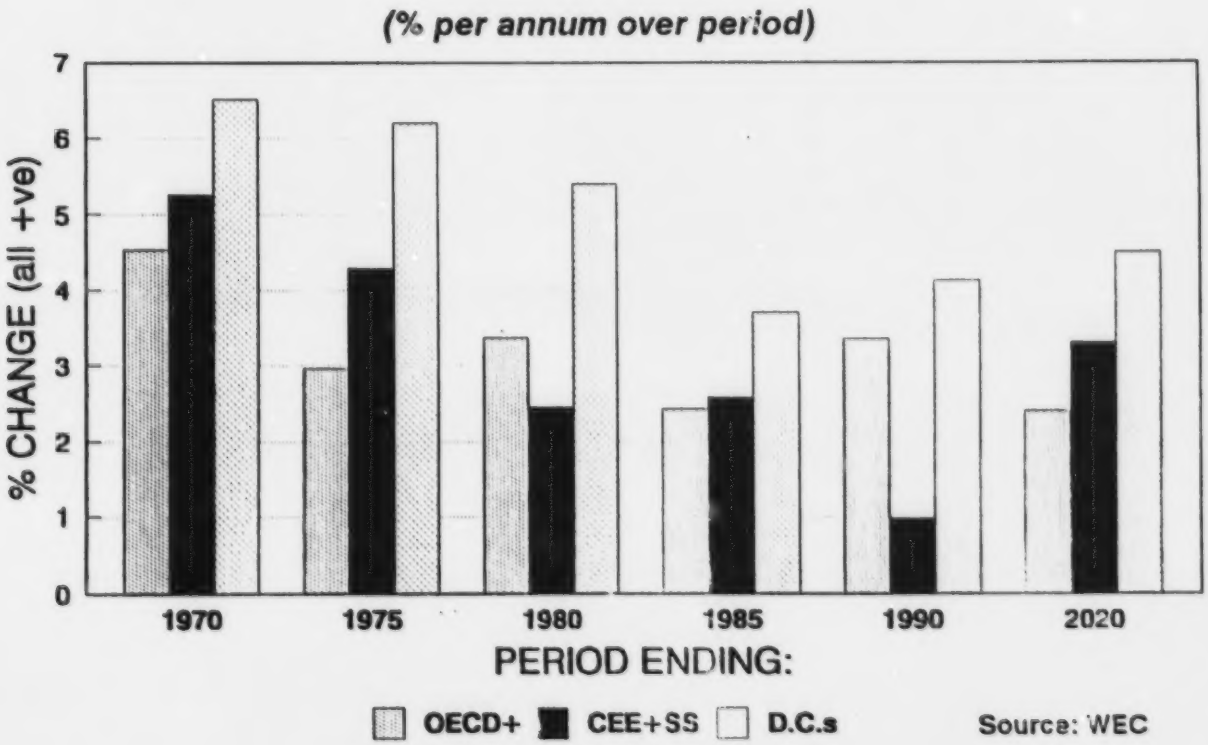


Figure 5: Regional Economic Growth Rates

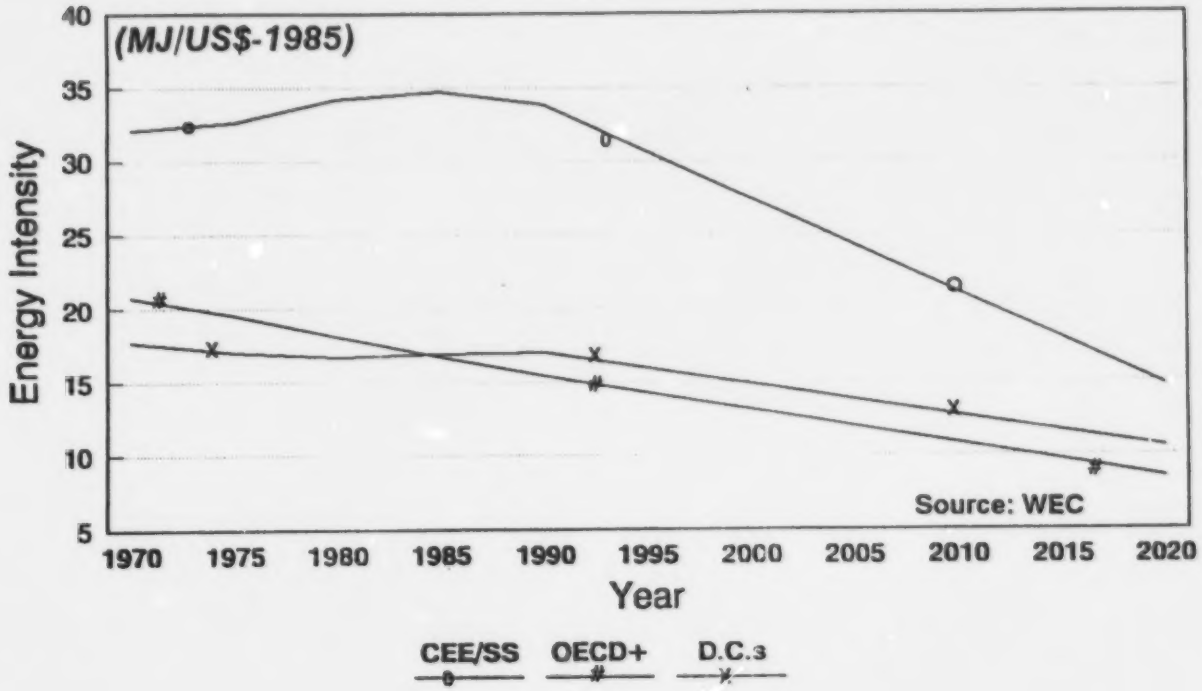


Figure 6: Energy Intensity

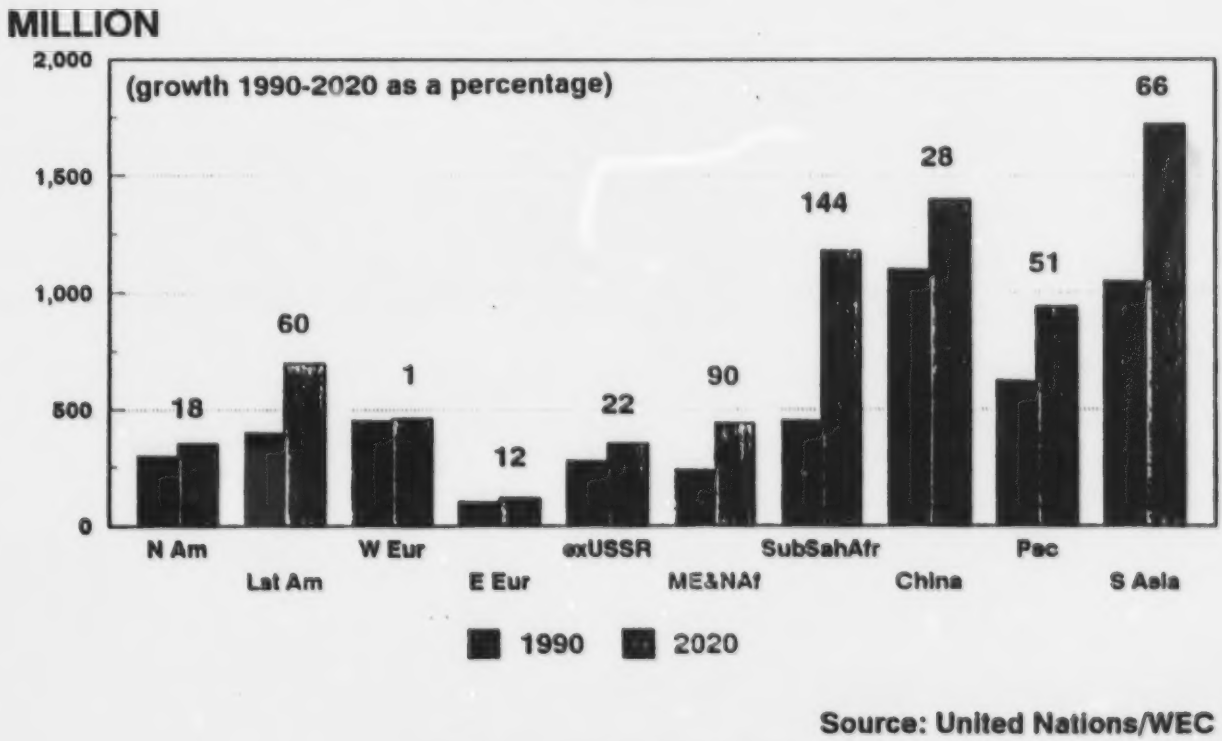


Figure 7: Regional Population Growth

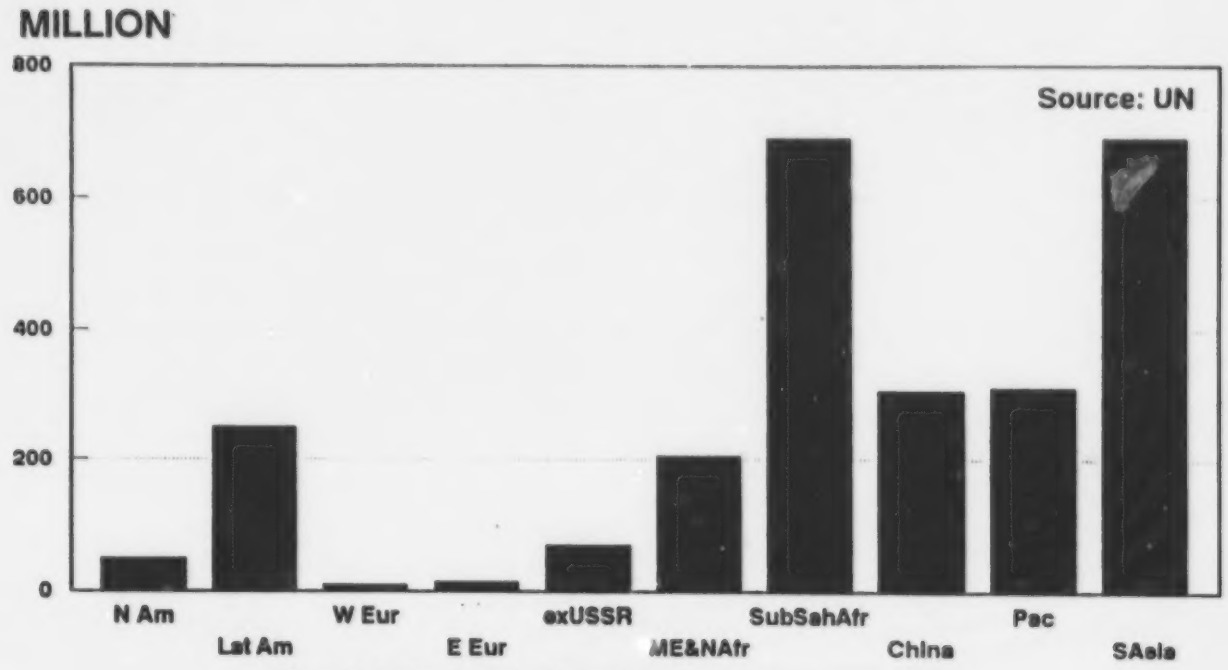


Figure 8: Projected Regional Population Growth From 1990 to 2020

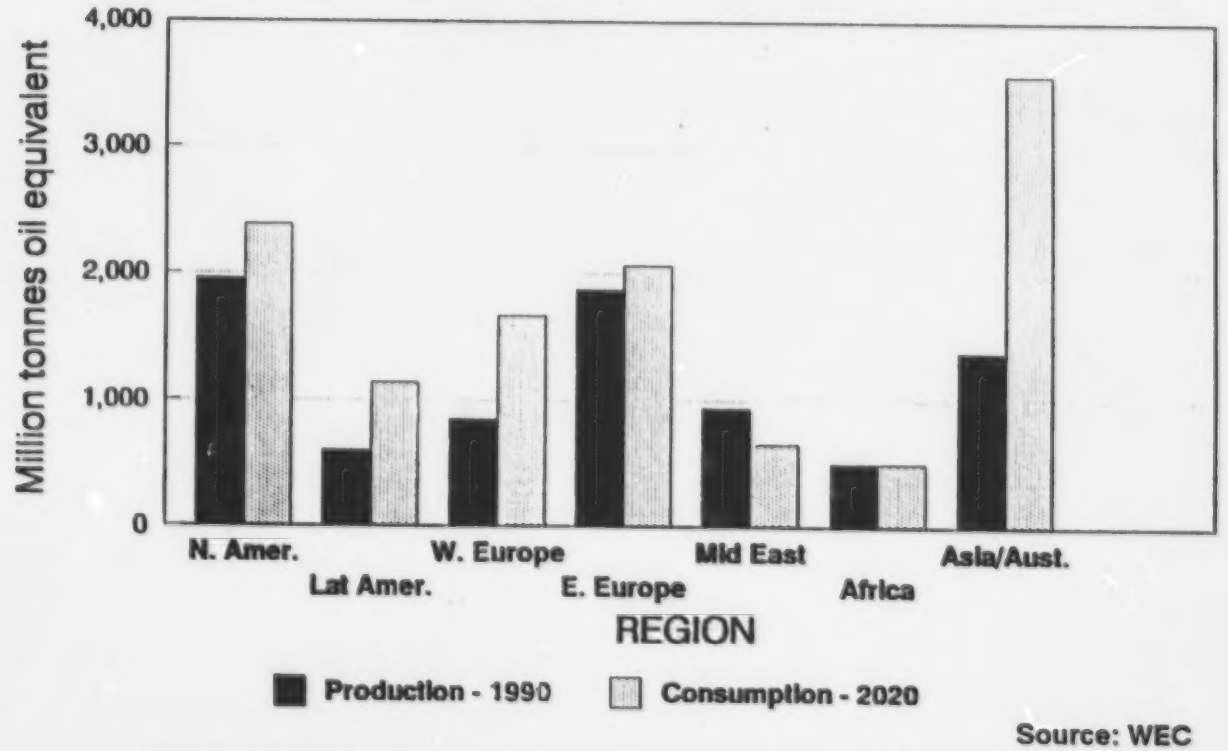


Figure 9: Projected Regional Consumption in 2020 Compared to 1990 Production Capacity

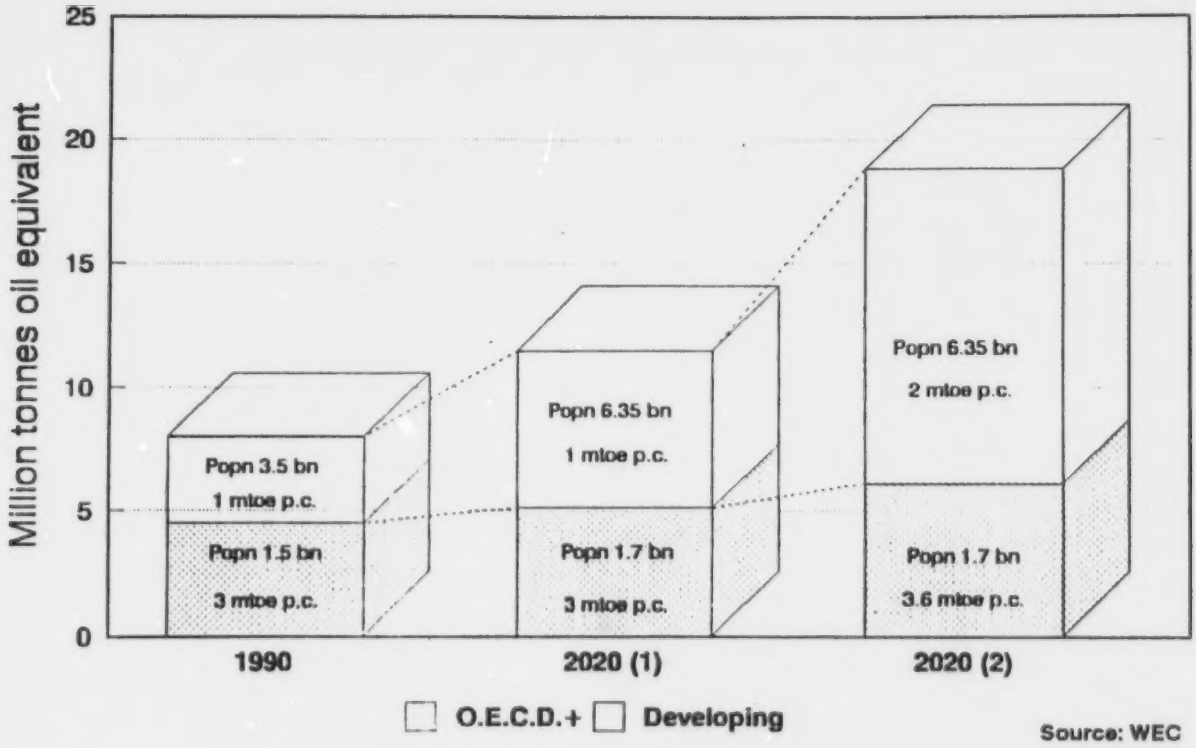


Figure 10: Forecasts of Population Growth and Energy Demand

	INDUSTRIALISED COUNTRIES	ECONOMIES in TRANSITION	DEVELOPING COUNTRIES High GNP per Capita	DEVELOPING COUNTRIES Low GNP per Capita	POPULATION Million (%)
	Population - mn	Population - mn	Population - mn	Population - mn	Population - mn
En'y Rich Exporters	250	0	600	100	950 (12%)
En'y Rich Importers	550	0	800	2100	3450 (42%)
En'y Poor Importers	450	0	300	3000	3750 (46%)
Population - million	1250	0	1700	5200	8150 (100%)
Population - % total	15%	0%	21%	64%	Source: WEC

Figure 11: Patterns of Energy Flow in 2020

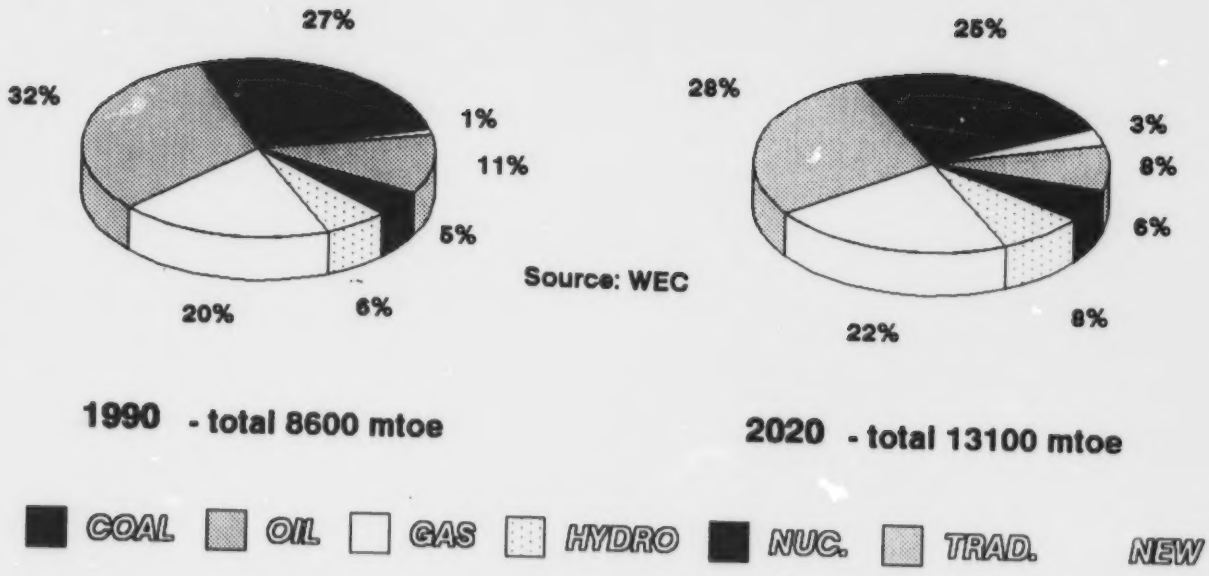


Figure 12: Percentage Comparison of Fuel Shares in 1990 and 2020

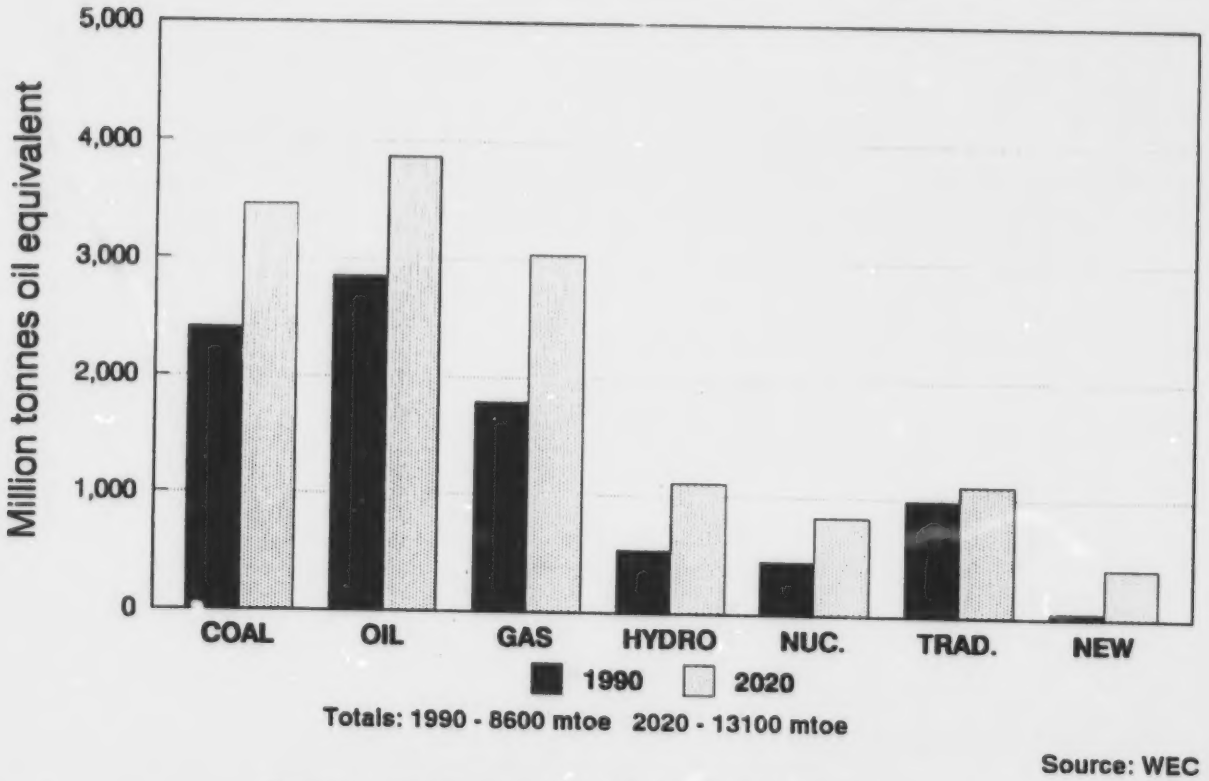


Figure 13: Absolute Comparison of Fuel Shares in 1990 and 2020

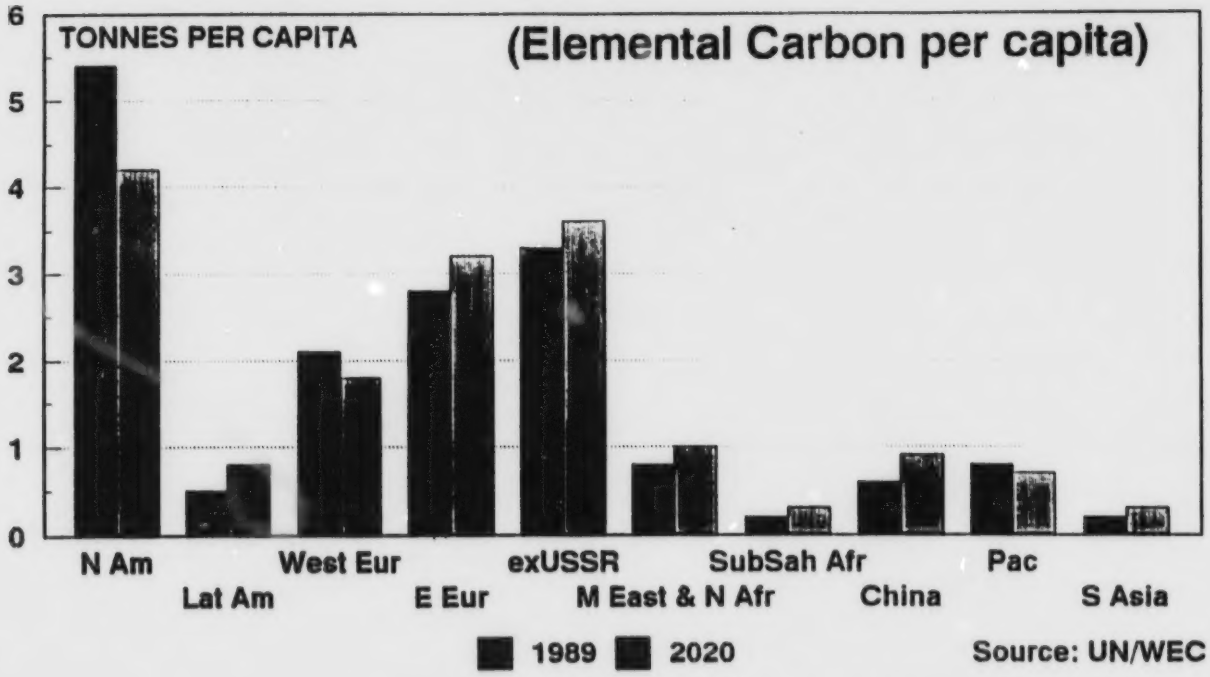


Figure 14: Regional Trends in Carbon Dioxide Emissions in 1989 and 2020

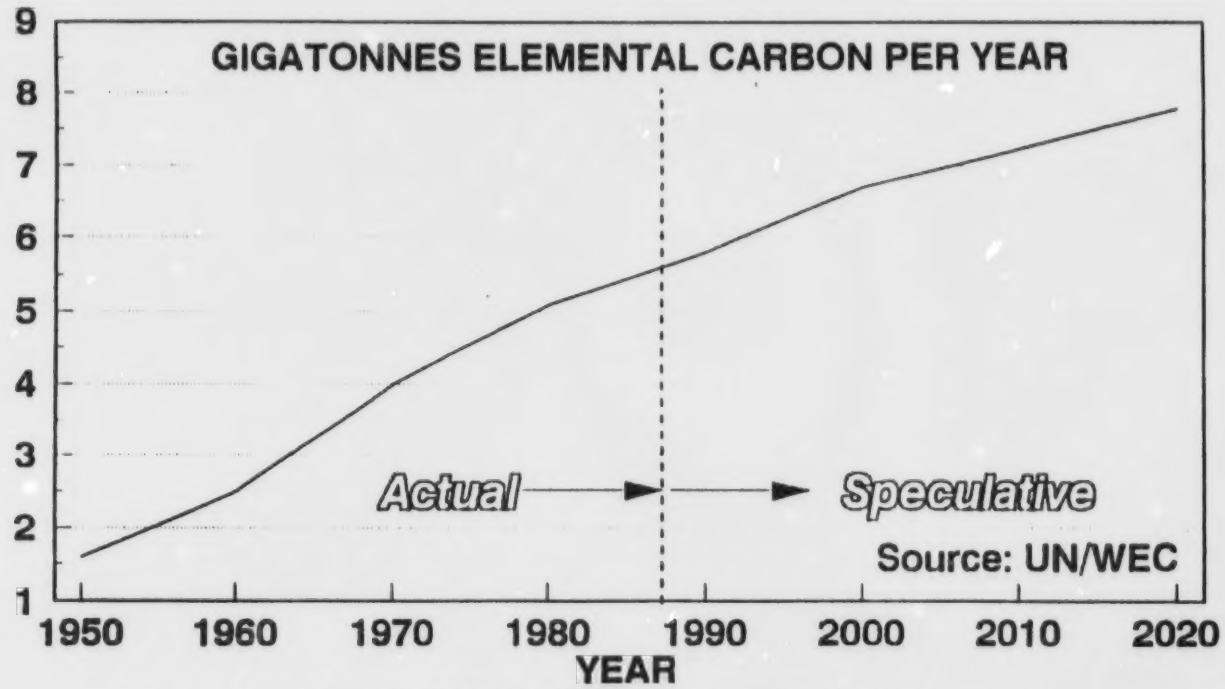


Figure 15: The Global Trend in Carbon Dioxide Emissions

The Architecture of Our Evolving Energy System

David Scott

Director, Institute of Integrated Energy Systems
The University of Victoria

Introduction of Dr. David Scott by John Foster

Our next speaker is Doctor David Scott, who could also be called 'Doctor Hydrogen.' He is a Professor of Mechanical Engineering at the University of Victoria, where he is also the Director of the Institute for Integrated Energy Systems (IESVic). IESVic is engaged in the development of energy systems that emphasize the use of low-carbon fuels, particularly hydrogen and natural gas. Previously, Dr. Scott chaired the Canadian Advisory Group on Hydrogen Opportunities, was the founding Executive Director of the Institute for Hydrogen Systems and was a Professor and Chairman of Mechanical Engineering at the University of Toronto.

Although David's first choice is hydrogen, he is now prepared to tolerate a little carbon, I believe. Dr. Scott is going to speak on "The Architecture of our Evolving Energy System".

Please welcome Dr. David Scott.

1. Introduction

This paper[1] looks at the *architecture* of the energy system and how the *components* of that architecture are evolving.

The rate and nature of this evolution can be used to identify business development opportunities. We will look at the system to identify *barriers* or *attractors* to the seemingly preordained systemic evolution. It is these barriers and attractors that are particularly fruitful sites for business development opportunities and the flip side of these, business interruption insurance. They are also key to energy system evolution.

Before we get to the energy system architecture, I would like to introduce some ideas through a parable.

2. The Parable of The Turning Out The Lights

In 1973, OPEC imposed its famous oil embargo. It was not the first oil embargo, it was just the first we remember because it worked. The first embargo, in *that* series of oil embargoes, occurred in 1967. It didn't work because there was sufficient marginal supply capacity and, more importantly, marginal delivery capacity to allow the system to respond with comparative ease. In 1973, the marginal capacity in both supply and delivery was much smaller. Thus the oil embargo led to economic shock followed by readjustments throughout developing nations. For a more complete discussion, see Reference 1. Although it was an *oil embargo*, it came to be called an *energy crisis*. This transformation in name was not brought about by chicanery. It came about because our media like, first, to simplify and, second, to use words with zing. 'Crisis' has more zing than 'embargo' and perhaps the media thought that by switching from 'oil' to 'energy,' more people would understand.

If the words 'energy crisis' are used enough, we begin to respond as if we *have* an energy crisis. Large institutions and governments, the great followers of mainstream thinking, develop policies appropriate for an energy crisis rather than an oil embargo.

Ontario Hydro, one of the world's great electric utilities, took up the banner and marched out to defeat the energy crisis, a crisis which, as "everyone knew," meant we were running out of energy and that meant a shortage of energy sources.

Large institutions like Ontario Hydro take a few years to adapt to changes in mainstream thinking. But by 1978, its Annual Report was all about conserving or saving electricity. How you 'save' electricity, I will never know. But that was, and often still is, the common rhetoric. The centrefold of the Annual Report contained two cityscapes of downtown Toronto, both taken during early February. One was taken at about 1700 hours, when the city was brilliantly lit with skyscrapers in the foreground against the magnificent pink sky of a winter's late afternoon sunset. The other was taken later that same evening, about 2000 hours, when the city and the sky were black. All is black because we were 'saving' electricity by turning out the lights!

It is cold in Toronto during February. If we turn out the lights we must turn on the boilers. If we turn out the

1 Some topics were not presented in the lecture.

lights we 'back out' those energy sources that generate electricity for the lights. In Ontario, these sources are uranium, hydro and coal. Overwhelmingly, boilers are fed by oil. Turning out the lights backed out indigenous uranium and renewable hydro and pulled in foreign crude, tens of millions of dollars of foreign crude.

So what is the message in the parable? I used to think there was one message: **Words shape actions.**

That is why, as a technical person watching our evolving energy system, trying to make sense out of what has happened and what should happen in the future, I have become obsessed with the need for care when using language. This care is not wrapped in 'Miss Grundy' rules about split infinitives or not ending sentences with prepositions. It is care with *words*. Most importantly, words that are descriptors of concepts and issues which must be clearly understood if rational public policy is to result.

More recently I have come to realize that the parable carries two further messages:

- Always think about the **System**, and
- The system is driven by the **Services.**

The importance of the *system* is self-evident from the parable. The importance of services is less clear. In the parable, a subtle point is that *two* services were provided. The first and most obvious was illumination. But space heating was a co-service. We don't often think of electric light bulbs as a co-generation technology, but in the winter, in Toronto, that is what they are.

3. The Energy Sector and Energy Currencies

Let us begin discussion of the energy system with a zoom into the energy *sector*. The energy crisis placed a special focus on the energy sector. In part this focus emerged from the 'running out' myth of mainstream thinking which accelerated the hunt for new energy sources. In most people's minds, providing more energy is the responsibility of the energy sector.

Mainstream obsession with new energy sources has continued to deflect thinking from a critical systemic issue: what *currencies* will these sources manufacture?

The architecture of the energy sector is represented by **Figure 1**. It is a three-link chain: sources, transformer technologies and currencies. There is no horizontal correlation among the examples used to illustrate each of the three links.

What I have called an energy currency is sometimes described as an energy carrier or secondary energy source. The reason I chose 'currency' rather than one of the more familiar terms is not a lust for uniqueness. It is because **words shape actions** and while mainstream terminology is comforting in its familiarity, that same familiarity can hide important nuances in the *role* played by currencies. Hiding these nuances makes it more difficult to gain a holistic appreciation of how the system works because:

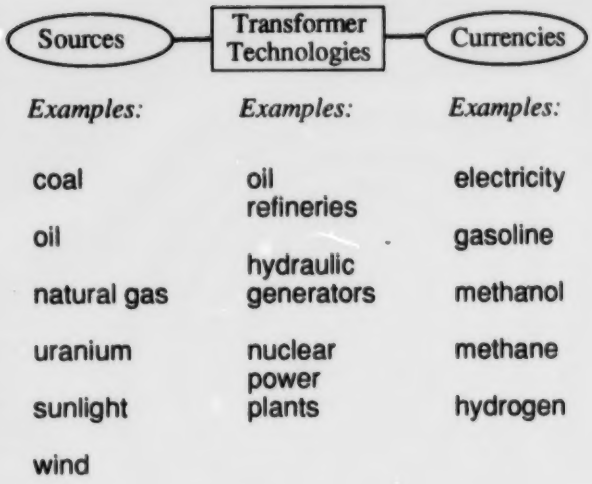


Figure 1: The Energy Sectors

- The role of an energy currency is *entirely different* than the role of an energy source, and
- The role of an energy currency is *much more* than only an energy carrier.

An energy currency is analogous to a financial currency. A financial currency allows financial transactions but is not, itself, a source of wealth. An energy currency allows energy transactions, is not a source of energy, but it *is* often the determining factor in whether and how a source *can* be harvested, and most importantly, for *what end service*. The last of these highlights that *the nature of a currency determines the nature of transactions that may be accomplished by that currency*. Therefore, when the currency is selected, the possible transactions are bounded.

This is also true, of course, for financial currencies. Dollars, Deutsch marks, bank drafts or telecurrencies, in the form of electrons running through wires or photons flying to and from satellites, are bounded in the financial services they can provide. A dollar can be used to buy a chocolate bar, although you might need more than one if you are in an airport. A telecurrency can move a billion dollars from New York to Tokyo capturing a 24-hour spike in interest rates and keeping money working over a skiing weekend. But the transactions of dollars and telecurrencies are not easily interchangeable.

There are even more rigid bounds on energy currencies. These examples put flesh on the abstraction:

- It is difficult to fly an airplane with the energy currency electricity, and
- It is difficult to run a computer with the energy currency turbofuel.

All this may seem silly because it is so obvious. Yet the parable suggests it's not obvious. Moreover, it leads to two observations. First, the *value* of harvesting energy sources is *intimately* tied to the currency that will be delivered by harvesting. Second, the currencies delivered *absolutely* determine the markets open to the sources being harvested.

Public and institutional fascination with finding new sources *should always* be inseparable from the currencies those sources will manufacture. To the detriment of public thinking, and therefore to the quality of public policy, it is the opposite today – there is a conceptual disconnection.

In the first few days of 'cold fusion' excitement, how many commentators from CBS, NBC or even the *New York Times*, asked, "What currency will cold fusion *make* if it *does* work? What services will that currency allow cold fusion to supply?" I think no one asked. One of the reasons they didn't ask is because they didn't know the concept. In order to have a concept, you must have a word that encapsulates the concept.

4. The Energy System

The parable of turning out the lights says, "Consider the system!" The system is reresented in **Figure 2**. The columns of examples under each of the five links have, again, no special correlation along the rows.

To treat the system holistically, we need to include what the economists call externalities. In particular, we must consider:

- Material extracted from the surroundings at each point in the chain,
- Material diverted within the surroundings at each point in the chain, and
- Emissions to the environment at each point in the chain.

Material from the surroundings might be coal, oil or uranium. But we must also include the diversion of material flows caused by such things as dams for hydroelectric generation.

Emissions to the environment must not only consider *what* is emitted, but also *where* in the system chain, and in what *concentrations*.

This last idea can be illustrated by considering transportation as the service and methane (CH_4) as the source. If methane is carried onboard, then the emitted CO_2 comes out a *mobile* tailpipe *diluted* by the nitrogen contained in the air bringing the oxygen for combustion. On the other hand, if the service-to-methane pathway involved steam-methane reforming (SMR) to produce the hydrogen, which is then used as the on-board currency, then the CO_2 comes off at a *stationary* site. Since some or all of the CO_2 is relatively pure, depending upon the source of exogenous heat, it represents a commercial opportunity. It can be used for anything from an atmospheric nutrient in greenhouses, to tertiary oil recovery to a CO_2 supplement for light beer. And if anthropogenic CO_2 becomes as severe a climatic threat as some now think it will, the CO_2 might even be collected, liquefied and disposed in the Kaltwasser sphere of deep oceans. There are several opportunities for either using or disposing CO_2 if it comes from a stationary source like SMR hydrogen production, but these opportunities vanish if the CO_2 comes from a moving vehicle.

The next important feature of the energy system is that it is *driven from right to left* in **Figure 2**. People buy services, they do not buy energy. They buy the right to talk to grandma, fly to Washington, or to secure information about their health through a CAT scan.

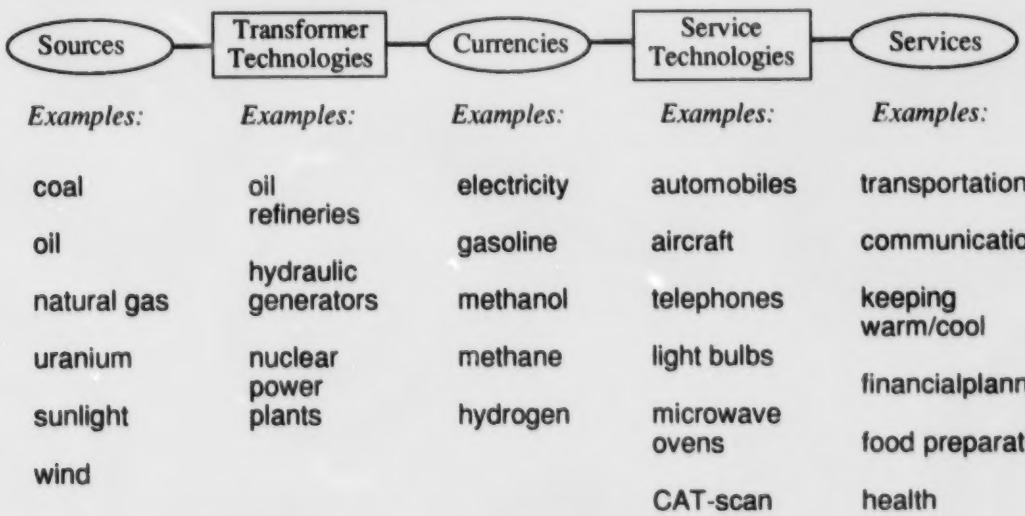


Figure 2: The Energy System

This seems so obvious in the telling, yet it is natural for those of us trained in engineering to plod through the system from left to right, from sources to currencies to services, for that is how the energy flows. But the energy flow is counter to the way the system works because it is a *cultural* system. Right-to-left has also been difficult to imbed in IESVic's routine thinking. To help, we require graduate students to look at systems and write theses in terms of services. For example, they will look at emissions, capital costs and primary energy required, all in terms of a service, like a passenger mile of city travel.

5. The Energy System and How It Works

Because we at IESVic had difficulty thinking right-to-left, we decided it was easier to reverse diagrams than to retrain brains, brains that have been 'taught' how to look at a page since kindergarten. So **Figure 3** graphically acknowledges what we have intellectually concluded – that the system is driven by services.

One implication is that energy sources don't matter much. That's a white knuckle statement, particularly for those of us who attend energy conferences, since we are often part of or aligned with some of the *sourcing* industries. Sources do matter to industry, but *culture* is shaped by the way the system delivers services.

For example, the late 20th century has been profoundly shaped by technologies which require the currency electricity: the FAX machines, computers, telephones and televisions which determine our perception of what we do and what others have done. It manifests itself in instant replays, of a touchdown pass at a football game or a 'smart' missile hitting a bunker in Baghdad. One of the reasons these technologies have been so contagious, and why they have penetrated every niche of our world, is that they all use electricity. That makes them *blind* to the sources harvested to make the electricity. What shapes the late 20th century are images of body counts, self-immolating monks, Challenger explosions and financial transactions allowed by tele-currencies. The energy sources that power these images and transactions are much less important.

We often hear the claim that civilization has an insatiable demand for energy. I believe that is incorrect. Rather, civilization has an insatiable demand for energy *services*.

Most energy services have a surprisingly low *fundamental* need for energy. It is today's technologies, the way transportation is delivered, that requires the energy. For example, to return from a visit to Geneva, Switzerland, to my home by the sea in Victoria, I could imagine an evacuated *straight* tube through the earth. I could imagine sitting in a comfortable capsule sliding downhill halfway to Victoria, coasting gently to a stop during the second half of the trip. If friction losses could be neglected, there would be no energy cost at all. In principle, I would even get some energy back, because my home is about 5 meters above the sea and Geneva is

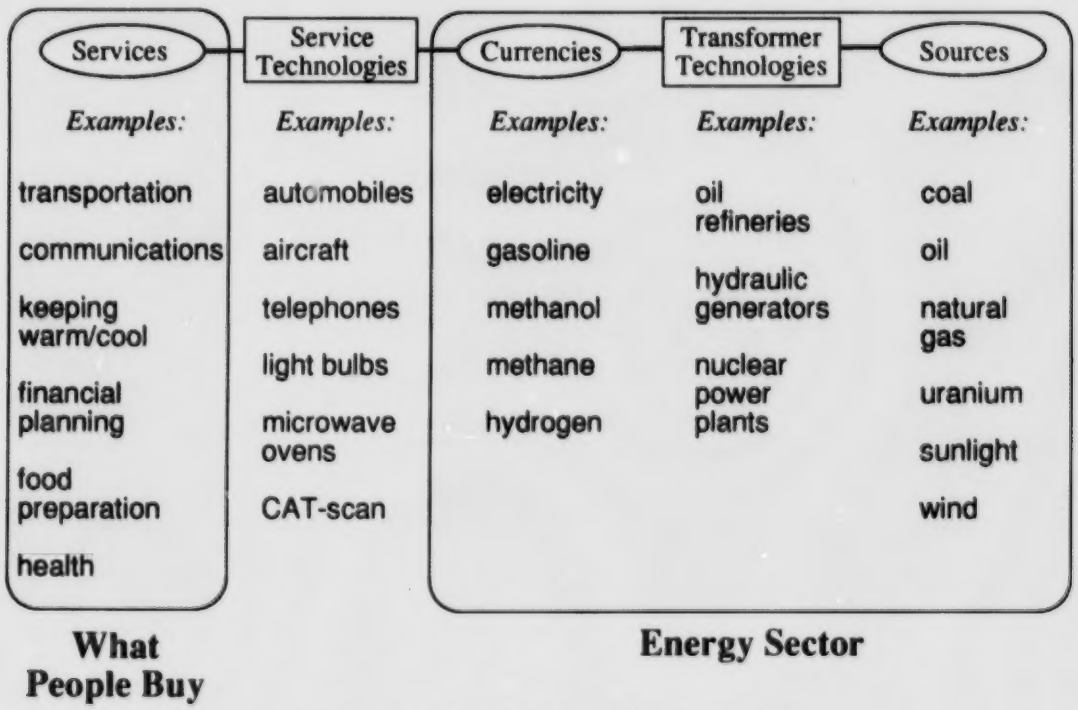


Figure 3: The Energy System and How It Works

approximately 375 meters above sea level. This might appear to be silly. And for *today's* state of our technological abilities and *expectations*, it *is* silly. But reduced to fundamentals, there is, in most cases, almost no limit to which we can shrink the ratio of energy used to the energy services provided.

Figure 3 gives the architecture of the energy system. The five *functional* links of this architecture are constant. Also, the fundamental services, the business of keeping warm, being able to communicate, or wanting to be healthy were as true for hunter-gatherer societies or medieval societies as they are for us today.

What *does* evolve is the way we *realize* the four right-hand functional links: service technologies, currencies, transformer technologies and sources. The components of these four links of the system *do* evolve. And of these four, we ask:

- What is the **rate** of the component evolution?
- What are the **barriers and attractors** to this evolution?

These are the issues I will address next. But first let us pause, for a moment, to note that energy conservation is not among the examples of energy sources listed under the right-hand column.

6. Conservation is Not an Energy Source

The word conservation, as far as the environmental movement is concerned, has its root in conserving of ecosystems such as forests, whales and wetlands, and in ensuring biodiversity. It may also have a second parent that grows out of the mythology of our oil embargo years: that we were 'running out of energy.' This was the mythology of the 60s culture. But in much of society, including industry (which should know better), it persists to this day. A current joint study by IESVic with IIASA (International Institute for Applied Systems Analysis) shows that man has so far released approximately 200 gigatons of carbon into the atmosphere from the consumption of fossil sources. Furthermore, at least 1,500 gigatons of carbon in fossil sources can be recovered at *less than $10 U.S. per barrel of oil equivalent.* Once again, we see that fossil fuel consumption is capped by environmental impact. There is no meaning to say that it is structurally capped by the lack of resources. So this kind of conservation, saving depletable fossil sources for a later day, has no practical meaning.

"Conservation as an energy source" is a phrase with an agenda, not a phrase to aid understanding. Still, the agenda may be appropriate, since it is often taken to mean two things: using available energy efficiently, and using fewer energy services.

Using energy efficiently really means maximizing the service delivered on the left column of Figure 3 for each unit of energy provided from the right column of Figure 3. This, of course, has been happening since the threshold of the industrial revolution, driven largely by economics and the customer's attraction to better services. Typically, efficiencies are improved most dramatically when systemic changes occur, as when illumination by coal oil lamps changes to illumination by electric light bulbs, transportation changed from ox carts to aircraft or communication changed from pony express to fax machines. Incremental changes to establish technologies will always help. Systemic changes are the real winners: hydrogen systems represent a systemic change.

There's a lot of talk but not much action on the concept of using less energy services. There will always be a small group of people who are prepared to 'do without.' But to be adopted across society, rather than just talked about across society, requires a long wait. This does not mean that lifestyle changes, especially if the result is seen as a better or more wholesome lifestyle, cannot reduce the need for some services. Consider commuting. If at all possible, I prefer to ride my bicycle and leave my car in the garage. This has not really changed the need for the service, which is to deliver me from home to the university, but it has changed the system that delivers the service. This will never be accomplished by laws that say I can't take my car. But it can be encouraged by people thinking about providing attractive infrastructures for bicyclists: good bicycle routes through the city, bicycle lock-up shelters at the workplace and convenient shower and locker facilities.

The point is only wealthy societies can afford to be clean societies. Wealthy societies are those which enjoy widespread and efficiently delivered energy services. Cutting back on services will, in the longer run, induce poverty, the most devastating of environmental damages. Delivering energy efficiently, particularly with systems which have inherently low intrusiveness on the environment, is the way to both create wealth and clean up.

Using the phrase "conservation as an energy source" is very misleading and, I believe, certainly damaging to the rational thought that is so important in planning our evolving energy system.

Conservation of energy is perhaps the most proven and basic law of nature. It is not a policy of fallible humans.

If we honestly want good public understanding - particularly, if we want to develop understanding in young people such as school children, we must not clutter and confuse the issue. We must not introduce "conservation of energy" as a fundamental law of nature and, at the same time, use it as a phrase for public policy.

We have a perfectly good word for public policy: *efficiency*. We should use it since **words shape actions**.

7. The Energy System of the Past

Figure 4 shows how the energy system might have

looked in the past. We can see the consistency of the architecture and the consistency of *generic* service. The top row and the left-hand column are unchanging but the rest change. Now it becomes interesting. I had my own fun with Figure 4, which is structured a little differently than Figures 1, 2 and 3 because this time there *is* a correlation along each row. If we go further back in time and select illumination, we could set out a sequence something like:

Illumination > Lamps > Whale Oil > Sailing Ships > Whales

You can have your own fun with this approach.

As we began to drill rather than hunt for illuminants, the price of illuminants dropped dramatically. Effectively, the price barrier vanished, to be replaced by storage barriers. The well-drillers quickly ran out of whiskey barrels to store the oil in as barrel prices leaped to more than two times the value of the oil in them. This spurred the steel barrel industry into being.

By analogy, a good business hunting strategy might be to ask yourself, "If the barrier for hydrogen storage is beaten by a certain storage technology, what will be the next barrier to pop up?" Being first in line with *that* technology would capture a real business opportunity.

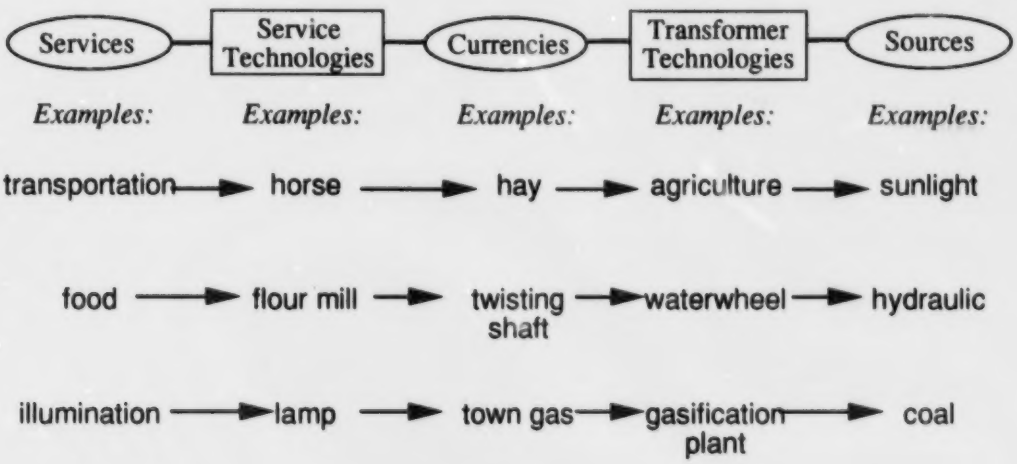


Figure 4: The Energy System of The Past

8. Thoughts on Barriers

The *biggest opportunities* are provided by knocking down the *largest barriers.*

The question is "Barriers to what?" And the answer is barriers to the seemingly pre-determined evolution of our energy system. So the reason we want a sense of the architecture and its evolution is to tease out the barriers to this evolution. Because those barriers represent business opportunities.

There is also the phenomenon of vanishing and reappearing barriers. I added the wrinkle on whale oil and whales a few lines back. Whale oil and animal fats used as *illuminants* were very expensive in the mid-1800s. That is why 'Colonel' Drake and 'Uncle Billie' Smith were drilling holes around Titusville, Pennsylvania, in the summer of 1859. And that is why Uncle Billie, coming out to see his well on a Sabbath afternoon, was ecstatic to see a dark fluid floating on top of the water. (These events are well recounted in Reference 1) This dark fluid eventually stopped the business of sending young boys halfway round the world in dangerous ships to hunt whales. It was easier to trudge a few miles inland and drill some holes in the ground.

When anticipating an emerging hydrogen age we should ask, "What will force the evolution?" The primary externality that will drive system change will be the environment, in particular, the prospect of climatic instabilities caused by atmospheric emissions. This will encourage low- and zero-carbon content currencies. We have one such currency: electricity. But for those services powered by chemical fuels, carbon-based currencies prevail today.

Carbon is not so much used for, and is absolutely not needed for, its energy content. The essential feature of the carbon atom is its role as *liquefying agent* in conventional fuels. Carbon facilitates onboard storage as it allows liquid currencies to slosh about in steel tanks underneath today's automobiles.

The low-carbon currencies most widely discussed today are methanol, methane and hydrogen. While methanol has the same carbon/hydrogen ratio as methane, it has a higher carbon/energy ratio and a much higher mass/energy ratio. Its *sole* advantage is that it can be liquefied by adding one more heavy atom. I expect that we will soon identify more efficient means of liquefying other low-carbon fuels.

The inverse of a barrier is an attractor. Several technologies are attractors for low-carbon fuels, especially for hydrogen. The most obvious is the fuel cell. Within the next few decades, fuel cell opportunities could mimic the magnitude of the micro-chip opportunities of the past three decades. But it is still so early in the fuel cell game, that we've only defined some of the losers, not any of the winners. And in some measure, winning fuel cell technologies will be determined by which technologies knock down the onboard storage barrier.

The fundamental attractor principles for hydrogen systems are easy to group. Firstly, some grow out of the unique chemistry such as its suitability for electrochemical processes, reduction processes and chemical balances like upgrading hydrogen-deficient fossil fuels. Secondly, other attractors exploit the high energy mass density, such as most types of transportation systems, but especially aircraft and space vehicles. Thirdly, there some which apply high leverage on the environmental benefits, such as mining vehicles, public transportation in urban settings with inversion layers, indoor skating rink flooding equipment, etc. Finally, we must remember that people buy systems, not technologies. The most attractive future systems will be those that exploit synergies that enhance several attractors. This should be a strategy for business development.

9. The Rate of Energy System Evolution

Figure 5, including its earlier forms, has been published widely, starting with Reference 2. It shows the market share evolution of the world's most significant energy *sources*. The source trends for the next fifty years are also projected in this Figure.

For the energy system, business as usual is characterized by a ponderous momentum. We have noted that, for cultural impact, sources hardly matter. But the essence of good science is to cast phenomena in terms that illuminate fundamental issues *easily*. That's what Figure 5 does in terms of sources. It is difficult to represent the evolution of the other functional links, like technologies and currencies, with such clarity. But the cadence of source competition is useful because it indirectly reflects the cadence of evolving technologies and currencies.

If the momentum of source evolution continues into the middle of the next century, the staple fossil source will be natural gas. And if natural gas achieves a market share that approaches the 70% share indicated by Figure 5, it *must become the staple source of transportation fuels*. The question is *how*?

It is not unreasonable to look at the growth projected for natural gas over early decades of the twenty-first century and conclude that this implies a rapid expansion of vehicles fuelled with liquid hydrogen. To acknowledge this pattern, which is not very different from the rise of coal corresponding to the emergence of the steel and railway industries, or the rise of oil (as a fuel rather than an illuminant) tied to the emergence and later dominance of the internal combustion engine. The peak years for natural gas may symbolize the invasion of

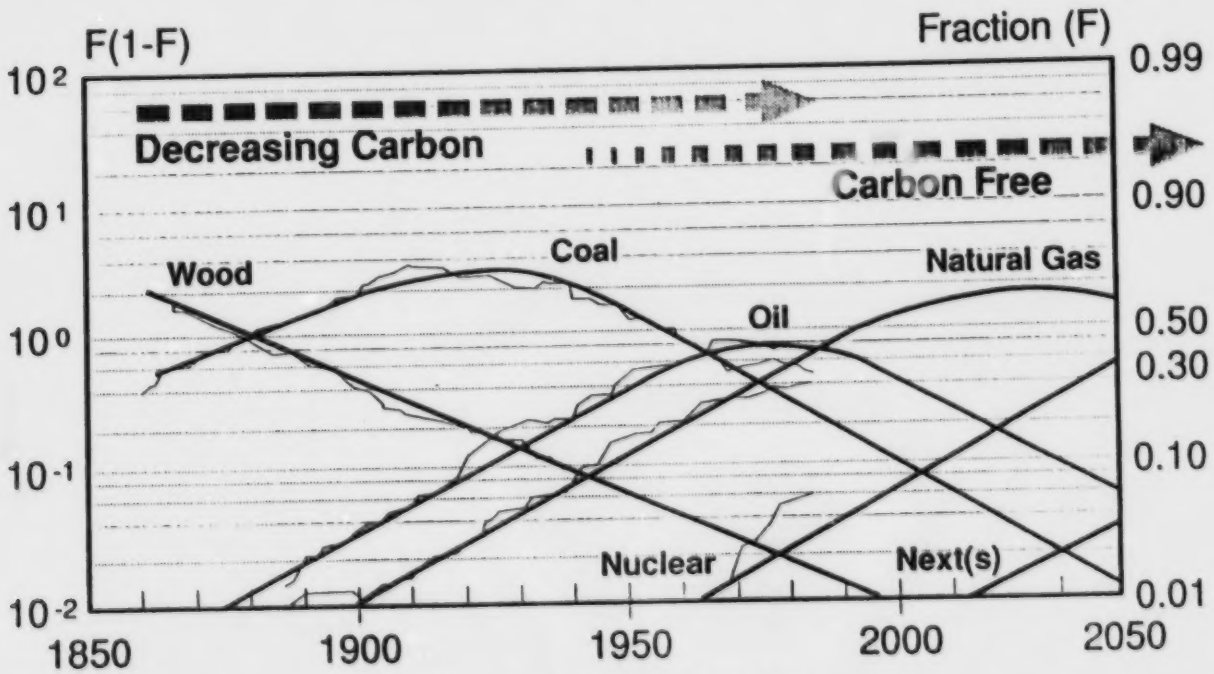


Figure 5: Energy Source Competition

transportation by fuel cells, bridged back to the natural gas source through the currency hydrogen.

Let's pause for some whimsy, whimsy that lies in the question, "What is significant about the year 2039?" You might think the answer has something to do with when coal and 'nexts' cross, according to Marchetti's (Ref.2) guess that some new source will come along about then. But that's not my whimsy. Freshman engineers begin university at about age 18. If they retire at age 65, 47 years from now, they will retire in 2039. If our energy system continues to evolve as it has over the last century, and many argue this evolution will speed up, then today's freshmen will retire into a startlingly different world. And their career opportunities will have a lot to do with exploiting the evolution towards that new world. We academics should think about that.

One way to start is to look more closely at the energy system towards which our world is evolving.

10. The Energy System of the Deep Future

The case for the inevitability of a hydrogen age has been covered well elsewhere. My own thoughts are set down in References 3 and 4. But there are many others, including several papers by Marchetti (Reference 2, for example), that are worth reading. A profound and thoughtful presentation of the underlying fundamentals can be found in Reference 5. This inevitability is embedded in the world ultimately moving to sustainable non-fossil sources and non-carbon bearing currencies. The system characteristics are expected to be similar to those shown in **Figure 6.**

first blush of technology produced affluence (using comparatively crude technologies) to return to a conserver society based on long-lasting, high quality products. This last phase, which we are beginning today, is happily in phase with people's growing demand for cleaner environments and fewer garbage dumps.

With a final look at Figure 6, three points can be made:

- The transition to the hydrogen age will require between 50 to 100 years, if the historical rate of change shown in Figure 5 holds constant. I know of no persuasive argument that this rate should slow down. There are two arguments, a need for industrial revitalization and escalating environmental threats, which might, in fact, speed it up.
- The environmental externality is the *unequivocal* forcing function that will assure our energy system continues to evolve towards Figure 6. The modest uncertainty in timing relates to how the issue of *quantifiable* damage and risk is alloyed with what the public and industry *wants to believe*. And, resulting from this alloy, what attitudinal brew will be served up by governments in response.
- The next decade will be the time for positioning the various 'horses' on the race track to this new future. Which horses have the rail position will be determined before the turn of the century. And the horses are not just technologies. Nor are they just investors or corporate structures. Some of the most important horses are nations.

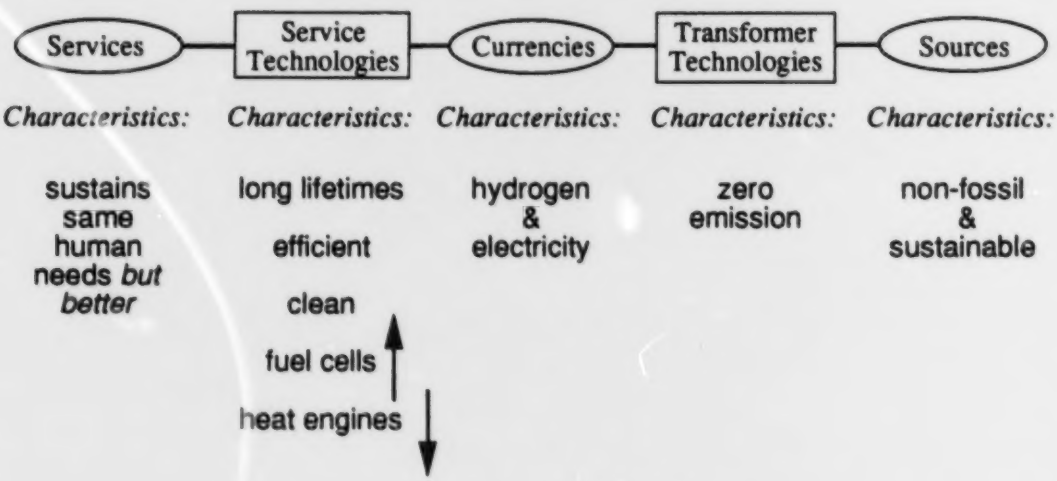


Figure 6: The Energy System of the Future

We should expect service technologies to be characterized by long lifetimes, high efficiencies and clean operation but, at least initially, high capital costs. The world will have evolved from a conserver society forced by poverty, through a throw-away society brought by the

11. Electricity & Hydrogen - Sharing Markets

The patterns in a deep future dominated by electricity and hydrogen will be determined by the synergistic characteristics of the two currencies:

- Hydrogen can be stored in enormous quantities;

electricity cannot,
- Electricity can transmit energy without moving material; hydrogen cannot,
- Hydrogen can be a chemical or material feedstock; electricity cannot,
- Electricity can process, transmit and store information; hydrogen cannot,
- On Earth, for long distance transport of energy, hydrogen wins, and
- In space, for long distance transport of energy, electricity, or its surrogate, electromagnetic radiation, wins.

The interchangeability of electricity and hydrogen via *electrolysis*, and hydrogen into electricity via *fuel cells*, will be an important feature of the hydrogen age. Today, oil can be converted into electricity but the reverse is not true. This irreversibility imposes a certain inflexibility on today's system. Inflexibility has, in effect, been beaten down with the mallet of high energy use rather than efficient *systemic* design. It also breeds cultural responses like the parable of turning out the lights.

12. Energy Services Palette

Figure 7 is another slide that teases out barriers and attractors to the systemic evolution shown in Figure 6. The palette is a free-form representation of energy services and how they are sourced. Like any free-form representation we can quibble over details. But the issue is whether there is value in the macro message.

The palette has two domains, one served by chemical fuels and one served by electricity. Fossil sources have access to the full palette. But the striking feature of today's system is that our new/old hopes are effectively restricted to manufacturing electricity, and are thus **trapped in an electricity service ghetto**.

The question becomes: how do we get solar energy, or wind energy, or tidal energy, or any of the "next(s)' to fly an airplane? The answer is hydrogen; it is the bridge from our new/old hopes to services now powered by chemical fuels. But as Figure 7 shows, this bridge is still incomplete; technologies are missing, institutional and physical infrastructures do not exist, barriers need removing and attractors need improving.

This bridge is where the winners will plant seeds. It is where people, corporations and nations will become rich.

Curiously, a head start in completing the planks and trusses for this bridge need has little to do with the immediate unleashing of old/new hopes. Fuel cells were first deployed, and liquid hydrogen storage greatly enhanced, using hydrogen derived from natural gas to fly to the moon. Just as your computer or telephone is blind to the source that made the electricity it uses, a fuel cell powered by liquid hydrogen is blind to the source of the hydrogen. So methane-sourced hydrogen is a platform for technologies that will complete the bridge.

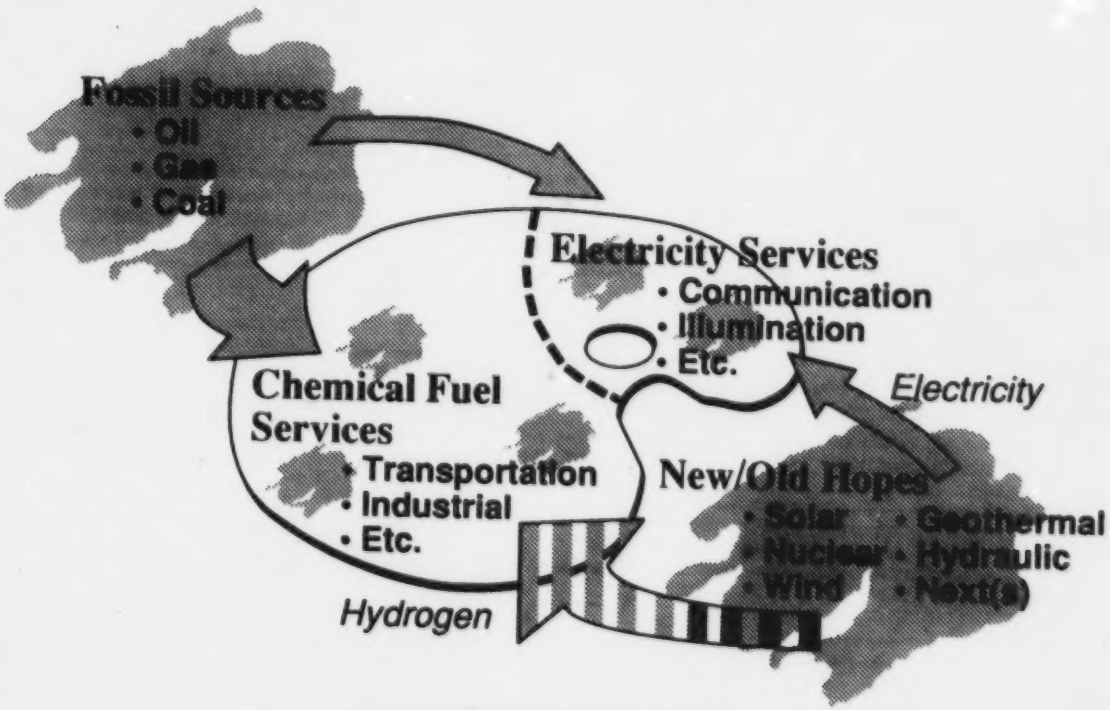


Figure 7: The Energy Services Palette

The services palette shows that the hydrogen bridge is needed before *any* of the new/old hopes can fulfil their promises. It is amazing that the need for this bridge is so rarely seen by those promoting their favourite new energy source. Completing the bridge consists of knocking down barriers and developing attractors. These are the areas of business opportunity.

13. On Business Opportunities

Since the beginning of the Industrial Revolution, and particularly since the oil embargo of the early 1970s, the world has seen a direct head-to-head competition between technology and energy. Technology has been winning; energy has been losing.

As an example, consider cars. Over the last two decades, we could either have used about the same amount of energy in technically crude automobiles similar to those of the early 70s, or we could have improved automobile technology to use less energy. We know what happened. Cars have become 'better' and use less energy. In home building, the technologies of better insulation and more efficient furnaces have reduced the amount of energy needed for heating and cooling. The same is true for aircraft and the same is true for light bulbs. In all cases, technology has won and energy has lost. The action will always be in innovation and knowledge with regard to service technologies.

There are also opportunities in energy currencies. The obvious ones are in manufacturing and conditioning currencies. As an example of conditioning, I mean the liquefying or compressing a currency like natural gas or hydrogen. With a visceral understanding of the way the energy system evolves, the 'real' barriers become apparent, and these may be onboard storage for either methane or hydrogen. These barriers represent the largest opportunity, and the people who knock them down can make billions of dollars. The alter ego of a barrier is an attractor, such as fuel cells. After barriers, attractors are the next category of large opportunities.

Finally, downstream integration to the point of service offers opportunity. Think about the fundamental service, not necessarily today's technology that delivers the service. Take Cunard Steamships, for example. Cunard sold ocean travel. They didn't sell, or at least didn't apparently perceive themselves to sell, international or intercontinental transportation. So, when you fly back to London or Ottawa or Bangkok you will not fly on Cunard Airlines. Canadian Pacific had another approach; they sold national and international transportation through their network of locomotives, ocean vessels, and more recently, aircraft.

There *are* advantages to considering your business in terms of the *generic* service you are selling, not just in terms of today's technologies for that service.

John Foster: Thank you, David. As usual, a very interesting, very perceptive and a very challenging presentation of your subject.

References

1. Yergin, D. *The Prize: The Epic Quest for Oil, Money and Power*, Simon and Schuster, ISBN 0-671-50248-4, 1991.
2. Marchetti, C. and Nakicenovic, N. *The Dynamics of Energy Systems and the Logistic Substitution Model*, RR-79-13, International Institute for Applied Systems Analysis (1979).
3. Scott, David S. et al. *Hydrogen: National Mission for Canada*, Report of the Canadian Advisory Group on Hydrogen Opportunities, Minister of Supply and Services Canada, ISBN 0-662-15544-0, June 1987.
4. Scott, D.S. and Häfele, W. "The Coming Hydrogen Age: Preventing World Climatic Disruption," *International Journal of Hydrogen Energy*, Vol.15, No. 10, pp 727-737, 1990.
5. Häfele, Wolf *Energy in a Finite World: A Global Systems Analysis*, Ballinger, ISBN 0-88410-642-X, 1981.

Environmental Constraints on the Energy System

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Introduction of John Hollins by John Foster

A key element in both the preceding talks this morning has been the environment and our next speaker is going to address that topic. He is Dr. John Hollins, who is a Director of Strategic Science in the Office of the Science Advisor at Environment Canada, and who is very well respected in the environment field both in Canada and internationally.

Following graduation with a Ph.D. in biophysics from the University of London, he conducted research on radionuclides in mammals at the National Research Council of Canada. He worked on renewable energy policy at Energy, Mines and Resources, and served as Director of the Energy Branch of Environment Canada. Dr. Hollins was Chairman of the OECD Group on Energy and the Environment, and is currently Chairman of the Executive Committee of the International Energy Agency's (IEA)research program on systems analysis of energy technologies.

He offers a very balanced approach to this subject. John is going to speak to us on environmental constraints on the energy system.

Energy System Environmental Constraints

Thank you very much, Dr. Foster. Good Morning, Ladies and Gentlemen. It is a great privilege for someone who works in glorious downtown Hull to come to the beautiful city of Victoria, to look over the Inner Harbour, rather than the Ottawa River, and to join you in this wonderful auditorium. Which reminds me of the Latin origins of the word 'auditorium,'... from 'audio,' to hear; and 'Taurus,' the bull!

Your job is to hear, I suppose, Mr. Chairman and my job, if I'm able, is to put some meat on the table. Now, Mr. Chairman, for we environmental folks, my title is perhaps a little bit like W. S. Gilbert's line, "Things are seldom what they seem." You read the title correctly; it's a title, I might add, which the Organizers proposed. But quite frankly, I think that the title is too pessimistic.

I would like to talk about some energy choices for a sustainable society and about dealing constructively with environmental requirements. Although I'm the speaker today, I would like to give credit to my research colleague Richard Loulou, at GERAD in Montreal, whose work I shall feature in the second part of my talk.

Mr. Chairman, I was inspired by Derek Davis' story of the cockney parrot and I recognize that I deal with a lot of those kinds of people, at least in the National Capital Region, and perhaps we are all a little bit like that. I'd like to take a few minutes to talk about what I consider some homespun environmental truths and then pick up on David Scott's themes and talk about the analysis of energy systems.

1. Preface

If a Forum on Trade and Energy had been organized ten or twenty years ago, we probably would have talked only about sources of energy and paid little or no attention to either energy efficiency or the natural environment. In November, 1990, Dr. E.F. Roots delivered a paper to a Canadian National Energy Forum in which he observed that consideration of energy choices *must now probe much more deeply into our economy, our way of life, and our politics*[1].

Environmental issues have also changed during the past decade or two:

- from concern about point sources of pollution and loss of local amenities to global issues such as climatic change and depletion of stratospheric ozone, and
- from questions about environmental management *per se* to recognition that decision-making by people in all walks of life is fundamental.

We are not masters or mistresses of the global ecosystem, or even stewards; we are an integral part of it! How can humans and their institutions better manage their affairs on this changing planet upon which we depend for our existence? Although we have all talked

†GERAD, La Groupe de Recherches et d'Etudes en Analyse des Decisionel is a joint research centre of the Ecole des Hautes Etudes Commerciales, Ecole Polytechnique, and McGill University, Montreal.

during the past two decades about managing the environment, the fact is, as Gordon Beanlands[2] put it, "We do not manage ecosystems, we manage people."

As our understanding of the relationship between human activities and the state of the environment has developed, it has become increasingly apparent that an approach is needed in which the principles and objectives of sustainable development are integrated into all spheres of public policy and private behaviour. This position was articulated by the World Commission on Environment and Development[3]:

> "The objective of sustainable development and the integrative nature of the challenge pose problems for national and international institutions that were established on the basis of narrow preoccupations and compartmentalized concerns. The ability to anticipate and prevent environmen-tal damage requires that the ecological dimension of policy be considered at the same time as the economic, trade, energy, agricultural, and other dimensions. They should be considered on the same agenda and in the same national and international institutions."

The basic analysis behind the Brundtland message was not new. The keynote study by the Club of Rome on Limits to Growth was built on a similar foundation, but it produced a rather dismal prognosis, in the tradition of Malthus. Brundtland had the wit to offer the same general findings in a much more positive and politically palatable form with its articulation of the concept of sustainable development.

The Brundtland message echoes Henry David Thoreau, who wrote 100 years ago that, "The cost of a thing is the amount of what I call life which is required to be exchanged for it immediately or in the long run."

In our prosperous societies, we have tended to forget costs other than the immediate and direct economic costs, discounted, of course; and most of us have the inertia of two centuries of the industrial age to contend with as we begin to rethink our place and practices on spaceship Earth.

Economic Man, which means most of us, is devoted to exponential growth: we are only happy if GNP grows by X percent a year, where X is a positive number between 2 and 5. But Ecological Man, or perhaps we should say Woman, knows that any natural process cannot sustain exponential growth indefinitely. Throw a couple of bacteria into a Petri dish and they will grow exponentially for a while, but then they reach a plateau. Vito Volterra, studying prey and predator fish in the 1920s, developed an equation to describe the population variations with time: it begins with an exponential term but then oscillates about an equilibrium level.

Robert Fulghum, the author of a delightful book of short essays entitled *All I Really Need to Know I Learned in Kindergarten*, made this point in a novel way by carrying the growth of human population to absurdity. He said,

> "If the population of earth were to increase at the present rate indefinitely, by 3530, the total mass of human flesh and blood would equal the mass of the earth."

That is a growth rate of not quite 2% a year, modest compared with the growth rate of some 6% or 7% a year that those of you in the electricity business have experienced for almost a century.

Exponential growth is clearly unsustainable, but it may be difficult to break our addiction to it. We are wont to think about technological solutions to our problems, which can certainly be part of the equation of sustainable development, as we shall show later; but the human dimension, our values and our ability to apply them as a society, may be even more important.

For us in Canada, it is worth remembering that sustainable development, as defined by Brundtland, is the policy of the Green Plan. The key issue is the integration of environmental and economic considerations in decision-making. We have to conduct ourselves in ways which do not draw down the environmental capital of the planet.

Sustainable development has moved rapidly into our vocabulary, but what does it mean? The political-policy backdrop is that sustainable development is a radical, fundamental concept, not business as usual. As Robert Slater[4] put it, "Sustainable development does not involve using a rear-view mirror to forecast. It is an optimistic, constructive ambiguity!"

There is not, and never will be, a single version of a sustainable society. We draw a parallel with the concept of democracy. Democracy and sustainable development are both simple concepts; in practice, they exist in different forms amongst different peoples and in different times. Patrick Watson, in his TV documentary, suggested that one way of knowing when there is democracy is by the presence of active debate and argument in society. A parallel sign for sustainable development may be a striving for the development of management by consensus amongst stakeholders, which may require democracy as a condition! It seems to us that each stakeholder, individual, corporation or nation must work out its own view of sustainable development or how to achieve a sustainable society. An interesting evolution of this theme has been developed by John Robinson and his colleagues at the University of Waterloo[5].

> "Sustainable development is fundamentally different: it is radical and extremely optimistic. It assumes that we are collectively smart enough to make the transition. The transition will involve

new patterns of production and consumption at the global level."

We must devote increasing attention to what Walter Truett Anderson[6] has called the design and governance of evolution:

> "Evolution no longer follows the Darwinian rules ... Today the driving force in evolution is human intelligence ... The world has changed and the human species, which has wrought the change, is now being required to change in response to conditions that we have created. The change calls for a massive reappraisal of basic ideas."

2. Energy, Environment and Trade

The linkages between energy and environment are so important that they need to be addressed in local, national, regional and global terms, and the basic ideas which underpin energy decisions certainly have to be re-examined. These linkages are so pervasive and fundamental that one of the very few energy forecasts that we can make with confidence is that the search for environmentally-sound energy options will be a leading issue – perhaps even the major focus – for both energy policy and research in this decade and into the next century.

One of the findings of a recent OECD Review[7] was that environmental considerations have moved in the past few years from a peripheral role in the formulation of energy policy and programs in OECD countries to a more central role, consistent with the findings of the World Commission on Environment and Development. They are likely to become even more important in the future.

We are not authorities on trade, but it seems likely that the importance of environmental factors is also growing in trade. Trade in technologies that solve environmental issues is a burgeoning sector, already as large in North America as the aerospace sector. A more subtle aspect is the behaviour of consumers vis-a-vis the environment and the evolving concept of sustainable development.

Trade in the future will involve environmental considerations from a broader perspective than the costs of environmental controls. Just as the brightest graduates are likely to move to employers with sound environmental objectives, international purchasers will assess the contribution of vendors to sustainable development. A foretaste of such factors was offered in the case of the seal hunt, and the issue is looming in the forest products sector. We had better get the environmental part of our energy equation right if we want to continue to trade in energy commodities, or perhaps even energy-intensive products!

3. Energy Analysis

Traditionally, energy thinking has addressed the constraint of the availability of sources of energy – 'energy security' was the buzz phrase of the late 1970s and early 1980s. It is now constrained more by the availability of environmental sinks – and achieving 'environmental security'. In most OECD countries, energy policy has been preoccupied with supply; electrical utilities, for example are generally mandated to supply whatever electricity the consumer desires at the lowest direct economic cost. We are at the early stages of addressing the real needs for energy services, that is, the production of the goods and services that we really desire, rather than the supply of energy *per se*.

Sir Arthur Currie, a former Principal of McGill University, observed that, "In the long story of the human race, it's the unexpected that happens."

Energy policy in the past depended upon forecasting, and has often been terribly surprised by events. One traditional approach to energy policy is econometric forecasting, basically the extrapolation of economic history. This may have worked while security meant assuring adequate sources of energy. Our security now depends on obtaining the services we desire that require energy by balancing our energy budget at the lowest economic cost and simultaneously satisfying our environmental requirements. New analytical tools are needed.

An alternative approach of 'backcasting' was developed in the early 1980s, an approach in which society would reflect on its values, determine what kind of a society it would like to be at some time in the future, and then develop ways of getting there.

The first Canadian study based on backcasting was conducted by Friends of the Earth, interestingly enough for the account of Energy, Mines and Resources and Environment Canada. Their overall result was that, even with an annual per capita economic growth of 2%, it would be cost effective to operate the Canadian economy using less energy in 2025 than it consumed in 1980.

The study on Soft Energy Paths for Canada[8] in 1983, the Brundtland Report in 1987, and the deliberations of the World Energy Conference in Montreal in 1989 make it clear that, whether one examines a rich industrial country or a poor undeveloped one, the largest and cheapest contribution to balancing an energy budget is greater efficiency. And for reasons that really go back to basic physics and biology, every time we save a unit of energy we are working in concert with, rather than against, those ecological imperatives to which we referred earlier. Even that bastion of traditional economics, the Organisation for Economic Cooperation and Development (OECD), adopted a Recommendation in 1985 that member countries promote the more efficient use of energy on environmental grounds.

Amory Lovins, of the Rocky Mountain Institute, coined the term 'Negawatts' to promote the idea of

practical energy efficiency. Lovins was, of course, the enfant terrible and scourge of the traditional energy analyst a decade ago, when the latter were predicting exponential growth in the price of oil. In retrospect, Lovins was in fact much closer to the truth than the conventional wisdom of that day.

Jim MacNeill developed the following dictum during his work as Secretary-General of the Brundtland Commission: "If we are to change the decisions we make, we have to change the ways in which we make decisions."

The basis of rational decision-making in energy, environment and trade is analysis. We need broader analytical methods for such analyses. Tools that are based on backcasting would be a valuable addition to our traditional methods of forecasting, and probably more germane to the problem of sustainable development.

The merits of back-casting were recognized by the NOVEM/IEA/OECD Executive Conference on Energy Technology Policy for Sustainable Development in December 1991[9]. It concluded that systems analysis provides constructive approaches as we seek to address energy technology options that will satisfy environmental requirements. One Working Group saw no use in continuing to follow traditional approaches to this question. It felt that a brand-new, creative approach is needed, starting from first principles.

It also concluded that communication (in the sense of cybernetic development of insight and understanding rather than the simple transfer of information) amongst systems analysts, clients and potential clients, policy advisors and decision-makers, and other interested people is critically important. It commended the practice of Reference Groups for systems analysis of policy options, a practice pioneered through work with the IEA's MARKAL model in Sweden.

It recommended that reference groups be used routinely to:

- foster partnerships between professional analysts, decision-makers and other interested parties,
- facilitate the interpretation of analyses in terms that decision-makers can understand, and
- serve as honest brokers in the assessment of emerging technologies.

It noted that there are many analysts, but few people capable of synthesizing findings for other audiences; there is a need to train and promote the skills of interpretation and synthesis.

The greatest potential value of systems analysis of energy technology options lies in its application to the global issues of sustainable development. It is evident that this requires agreement by analysts in different countries on common approaches to many methodological issues.

It does matter to Canada whether India uses CFCs in refrigeration and how China uses its vast coal reserves. In the past, developmental aid was perhaps a matter of conscience, equity, or guilt. It should now be recognized as being in the self-interest of the donors as well.

4. MARKAL, a Multi-disciplinary Systems Approach

If Dr. Slater is right that sustainable development requires us to look forward through the windshield as well as keeping an eye on the rearview mirror, then we need to add some new tools to the traditional analytical wrenches in our toolbox.

One interesting candidate has been developed by the International Energy Agency's Energy Technology Systems Analysis Programme (ETSAP). This programme uses a large linear programming model, MARKAL, to examine optimal mixes of energy technologies to secure environmental requirements at minimum economic cost. We are champions of this approach, but we insist that a range of complementary analytical tools are needed for sound decision-making. Reliance on econometric modelling alone, or on optimization modelling alone, misses the complexity of social and technological systems which would form a sustainable society. The following discussion of MARKAL findings is offered in that spirit.

In the Netherlands, for example, the MARKAL model has been used to evaluate the available energy technology options to reduce emissions of CO_2 by 20% by 2005 and by 50% by 2050. Two baseline scenarios were used, one of which allowed modest increases in energy demand and future expansion of nuclear power ('Trend' scenario) and the other required reduction of demand, an 80% reduction in acid rain, and allowed no nuclear power ('Green' scenario). The model calculated optimal portfolios of energy technologies that would meet the requirement to reduce CO_2 in both scenarios. The results, **Figure 1**, are taken from Kram and Okken[10].

Let us share with you an initial sense of this way of addressing the economic and environmental constraints on energy choices from a technological point of view in Canada. As a contribution to the IEA research in ETSAP, we have begun modelling the control of CO_2 in Quebec and Ontario[11].

MARKAL is a large-scale, linear-programming model which computes a competitive partial equilibrium in an energy market subject to constraints such as scarcity of resources, availability of technologies, and upper bounds on emissions. MARKAL configures an optimal mix of technologies to satisfy exogenous economic demands at the minimum total discounted system cost. By running the model several times with

different CO_2 constraints, for example, it is possible to compute the net cost of the technological shifts selected by the model to meet the increasingly severe requirements. It can also examine cumulative requirements, such as reductions of NO_x, SO_2, and CO_2.

In the initial research at GERAD which we summarize here, we focussed on:

- the feasibility and cost of curbing CO_2 emissions by specified percentages in 2005 through to 2025 (the model is typically run for nine consecutive five-year periods starting in 1980 or 1985),
- the consequences for the supply of energy of imposing environmental constraints, and
- the technology substitutions proposed by the model.

4.1 Scenarios

Two sets of economic assumptions have been used so far (high and low cases), and three types of emission scenarios have been modelled:

F-F-F (Free Scenario): NO_x, SO_2, and CO_2 emissions are unconstrained (Free) over the entire time period,

C-50-F(Base Scenario): In 1990 and thereafter, NO_x emissions are constrained to the 1985 level; in 1995 and thereafter, SO_2 emissions are reduced to 50% of the1980 level; CO_2 emissions are free, and

C-50-C, C-50-10, C-50-20 (CO_2 Scenarios) and CO_2 emissions are first constrained in 2005 and thereafter at their level in 1985, and then reduced by 10% and 20%.

It is important to realize that in all scenarios, including the free scenarios, MARKAL solves for an economically optimal mix of energy technologies over a 45-year period. The solution of a Free Scenario is not 'business as usual', or an extrapolated forecast of past behaviour. The solution is the best mix of energy technologies possible based on economic considerations alone. It does not pretend to take the behaviour of the market into account; it is a technological solution.

In each constrained scenario, a global upper limit is imposed for the provincial system at each relevant period. The model responds in a systematic way by allocating reductions of CO_2 emissions, say, optimally, to the various segments of the energy system.

The model does not contain any technologies for the capture or disposal of CO_2 since that does not appear to be feasible in the two provinces studied to date. Our Dutch and Japanese colleagues in ETSAP have included such technologies in their database, which would be appropriate for modelling of, for example, Alberta in due course. The extensive database of the model covers switching of fuels and technologies, including industrial processes, new end-use devices, such as electric cars, and conservation measures in all sectors. No maximum rates of penetration have been specified for insulation, efficient lighting, etc., but improvements in the efficiency of automobiles have been constrained exogenously to reflect potential rates of penetration in the real market.

5. Findings

We can do no more in this paper than offer a flavour of our findings to date, and, we hope, our enthusiasm. But please remember that models are devices to help us to think, not to dictate prescriptions. Let us start with Quebec.

5.1 Quebec Analysis

Figure 2 presents the emissions of CO_2 in Quebec, as calculated by the model in the two upper curves (which have no CO_2 constraints), and as imposed by the analysis in the three lower curves.

In the Free Scenario, CO_2 emissions increase by some 80% from 1990 to 2020 in the high economic case, and by 47% in the low case. These increases occur even though many end-use energy savings are adopted by the model, following what is becoming conventional wisdom, despite the lack of any constraints on emissions. MARKAL optimizes the energy system in all scenarios, so that all technological 'no-regrets' decisions are indeed selected by the model in the F-F-F Scenario.

The imposition of the constraints in C-50-F on NO_x and SO_2 (our environmental research started with acid rain) results in a 13% reduction of emissions of CO_2 in the high case, while CO_2 itself was not constrained. Many of the technologies selected by the model to reduce NO_x also act to reduce CO_2. To a first approximation, both gases are linked to fossil fuel combustion. Another interesting observation is the relatively late date at which the model takes steps to reduce emissions of CO_2; in 1995 and 2000, the emissions are similar in all scenarios.

An interesting point from **Figure 3** is that emissions of NO_x are very much reduced when CO_2 is constrained, far below the imposed constraint for NO_x itself. This result is no surprise to those who have worked with MARKAL, which reveals such synergies with remarkable regularity.

The total discounted system cost of imposing the environmental constraints and the total quantities of CO_2 avoided are presented in **Figure 4**. The lines of reference (the axes) are the F-F-F Scenario, the economically-optimized but environmentally-unconstrained case. The average costs of reducing emission of CO_2 in Quebec in these technologically optimal systems in C$1990 per tonne are:

	High Case	Low Case
C-50-C	102	48
C-50-10	117	64
C-50-20	130	82

5.2 Marginal Costs: A Technological Basis for a CO_2 Tax?

In linear programming, a marginal cost of reducing emissions of CO_2 is available for each five-year period in each scenario. It is equal to the shadow price of the CO_2 constraint for that period. It is simply the cost of not emitting the last tonne of CO_2 in any given period. The evolution of marginal costs is presented in **Figure 5**.

The marginal costs exceed the average costs reported above. They could be interpreted as a first approximation for an efficient CO_2 tax. If a tax equal to the marginal cost of changing the technology in the energy system were applied to a population of economically-rational agents, then decisions that are optimal for each of the agents would also respect the CO_2 constraint applied in the model. In analytical terms, the CO_2 limits imposed upon the model could be lifted if emission taxes equal to the shadow prices were levied and if the agents are uniformly rational.

Although theoretical, this finding is of interest because it establishes a rigorous link between a prospective, technologically-based model like MARKAL and policy designed to influence the behaviour of that human institution, the market.

5.3 Energy Shares

The impact of CO_2 reductions on the mix of primary energy forms is profound. In **Figure 6**, electricity is computed as fossil equivalent and multiplied by 2.92. The acid gas reductions provoke a shift from oil to gas, whereas the CO_2 reductions provoke a shift from oil and gas towards hydroelectricity. Nuclear electricity does not penetrate in any scenario.

Oil imports drop significantly in the Base Scenario due to SO_2 and NO_2 constraints, and a further drastic drop occurs in the CO_2 Scenarios. Oil stabilizes at around 10% in both economic cases. The use of natural gas is interesting: its share almost triples from the Free to the Base Scenario in the high case as a means to reduce acid gas emissions. It then gradually decreases as CO_2 constraints are applied, stabilizing at around 10% as well.

It is remarkable that in this modelling, Quebec could still rely on its hydroelectric power to satisfy CO_2 constraints, even in the high case. Other types of constraints, clearly revealed in the recent past, provide us with other scenarios to be modelled in the future!

5.4 Energy Savings

Accounting for energy saved is not an easy task because some savings are embedded in the specifications of some technologies, whereas others result from optimization by the model. In **Figure 7** we show as savings all substitutions, retrofits, and other improvements selected by the model in end-use technologies and all built-in efficiency gains in demand devices, such as progressively more efficient vehicles and better insulated dwellings. The savings gained in some intermediate technologies such as industrial boilers are not accounted for because of the nature of the database, so these figures slightly under-estimate the savings proposed by the model.

Figure 8 shows energy savings for all emission scenarios, as a percentage of final energy for the whole system. Savings run from 23% in 2020 for the Base Scenario to 35% for a 20% reduction of CO_2. Please note that this figure is the closest we come to comparing MARKAL results to a business as usual scenario, which would be represented by zero savings at all periods.

5.5 Transportation Sector

This sector undergoes a profound evolution with the introduction of the environmental constraints. Whereas gasoline and diesel fuel are the only fuels used in this sector in 1990, **Figure 9** shows that in 2020, only the Free Scenario retains the supremacy of oil. Vehicles powered by natural gas make inroads in the Base Scenario for the high case, and in both cases for constant CO_2 (C-50-C). When the constraint on CO_2 becomes more severe, the proportion of natural gas retreats in the high case.

5.6 Ontario Analysis

In this short overview, we shall close with a point of comparison between the modelling of Quebec and Ontario, and an anomaly.

The average costs of reducing emissions of CO_2 are lower in the respective cases and scenarios in Ontario: there is more room to manoeuvre in Ontario in particular as a result of the greater diversity of sources of energy used in the generation of electricity. The average costs of reducing emissions of CO_2 in Ontario and Quebec in the high case in C$1990 per tonne are:

	Quebec	Ontario
C-50-C	102	50
C-50-10	117	67
C-50-20	130	115
Postpone	—	70

The costs in the low case for Ontario are approximately one-half of the costs in the high case. The marginal costs are presented in **Figure 10**. The main observation is the high value in 2005 of the shadow prices for all scenarios, especially in the most constrained 20% CO_2 scenario in the high case, where the shadow price soars to $2,200 a tonne! The model did find a technologically-possible solution by resorting to natural gas in a massive way, since it could not build nuclear plants in the time available. We therefore ran this Scenario with the date of constraint postponed to 2010, which represents a sufficient delay for the model to bring the marginal cost down to the same order as the other scenarios. The CO_2 shadow prices in C$1990 per tonne for the high case of the C-50-20 Scenario are described in the following tabulation.

Period	2005	2010	2015	2020	2025
2005*	220	90	117	137	268
2010*	0	102	104	123	241

*Date at which constraint was applied

As with Quebec, we plan to extend the scenarios to include, for example, a nuclear moratorium in Ontario. We also look forward to MARKAL modelling of other provinces.

6. Conclusion

The first conclusion of this modelling to date is that stabilization of emissions of CO_2 and reductions of up to 20% by 2005 are technologically feasible, although Ontario benefits greatly from a postponement of one five-year period. On the supply side, the Quebec system uses its massive potential in hydro-electricity, whereas the model selects nuclear in Ontario after 2010.

The costs of reduction are higher in Quebec than in Ontario. The existing CO_2 emissions are relatively lower, due to the a higher level of electrification from non-fossil sources, and further reductions are thus more difficult and more costly to effect. This reflects, in the microcosm, the larger global differences between, say, Switzerland and Germany. The average and marginal costs of introducing the most appropriate mix of technologies identified by the model puts a bound on what might be achieved in the marketplace and provides some insight for policy makers.

In our modelling of Ontario, we find that if we control acid gases but do not constrain CO_2, the least expensive mix of energy technologies does not include any nuclear electricity in 2025. On the other hand, if we require a 20% reduction in CO_2 with high economic growth, we cannot find a technical solution without nuclear energy. This is not a novel general conclusion, but it is confirmed in this case by our detailed modelling of the many hundreds of technologies in our database that are available for both the supply and demand side of the energy equation.

We are looking forward to doing more analyses of this kind, because in our view it leads to constructive thinking and sound decision-making. We are not offering outright solutions, but an opportunity for energy and environmental specialists and people concerned with policy and better decision-making to think things through in a technologically-sound, economically-informed and constructive manner.

MARKAL is an important tool that we think should be in many peoples' analytical toolboxes, along with other tools, such as the ISTUM model which has been successfully applied by our hosts, B.C. Hydro. Systems analysis has an important role to play in helping our society to secure an energy system to meet its reasonable economic demands as part of an ecosystem in which it can live in perpetuity.

I thank you, Mr. Chairman.

Thanks by Dr. John Foster: I compliment John on another excellent talk with much food for thought. I'm sure everybody here is looking forward to getting copies of this morning's papers in the Proceedings and being able to review these numbers.

References

1. E.F. Roots, Environmental Aspects of Canada's Energy Problems, Proceedings, Canadian National Energy Forum, 1990.
2. G. Beanlands, An Ecosystem-Based Approach to Environmental Management, Environment Canada Management Conference, April, 1992.
3. World Commission on Environment and Development, Our Common Future, Oxford University Press, 1987.
4. R.W. Slater, The Policy behind the Green Plan, Green Plan Forum, Montreal, 1992.
5. J. Robinson et al., Defining a Sustainable Society: Values, Principals and Definitions, Sustainable Society Project, Working Paper #1, University of Waterloo, 1990.
6. W.T. Anderson, To Govern Evolution, Harcourt Brace Jovanovich, 1987.
7. J.G. Hollins and J. Leggett, Integration of Energy and Environmental Policies in Canada and other OECD Countries, 14th World Energy Conference, 1989.
8. Friends of the Earth, 2025: Soft Energy Paths for Canada, Energy, Mines and Resources Canada, 1983
9. NOVEM/IEA/OECD Executive Conference, Noordwijk, 1991, in press.
10. T. Kram and P.A. Okken, The Case of the Netherlands: Two Low CO_2 Scenarios, in Estimating National Costs of Controlling Emissions from the Energy System, Brookhaven National Laboratory, 1990.
11. C. Berger, R. Loulou, J. Soucy, and J-P Waaub, CO_2 Control in Quebec and Ontario, ETSAP/IIASA Workshop, Laxenburg, Austria, 1992 (to appear in the Final Report of ETSAP, Annex 4, IEA [1992])

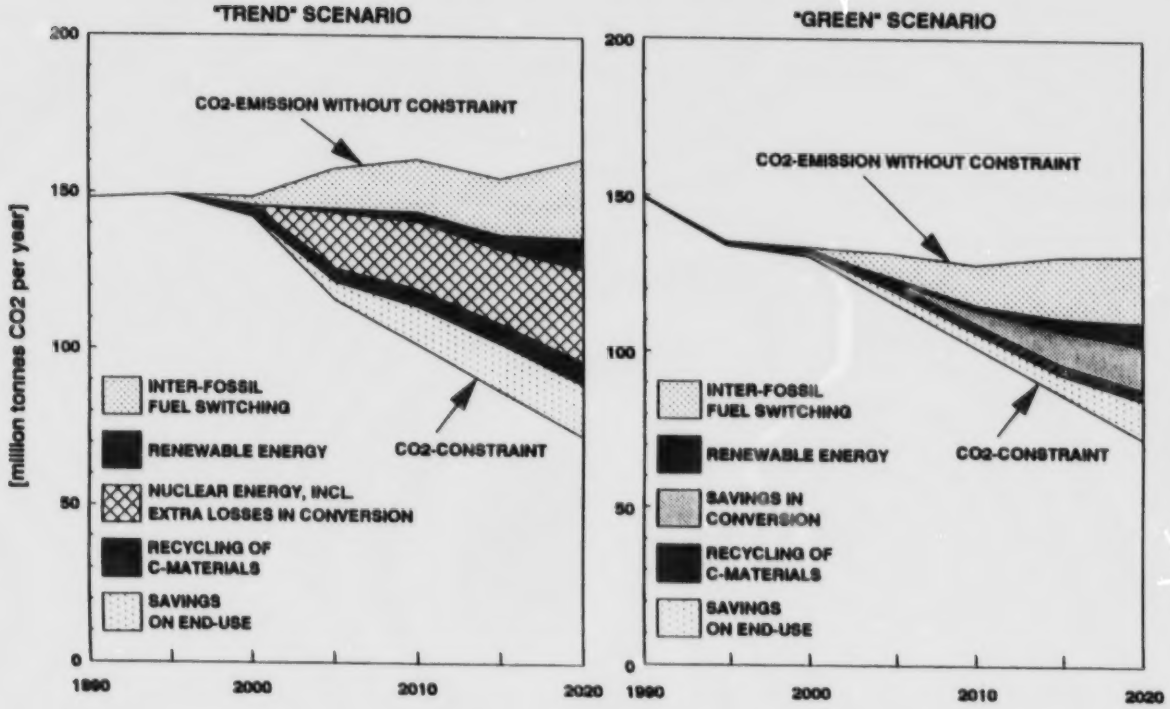


Figure 1: Contribution of Various Options to Reduce CO_2 Emissions by 50 percent in 2020 in Two Scenarios for the Netherlands, from Okken et al (1991)

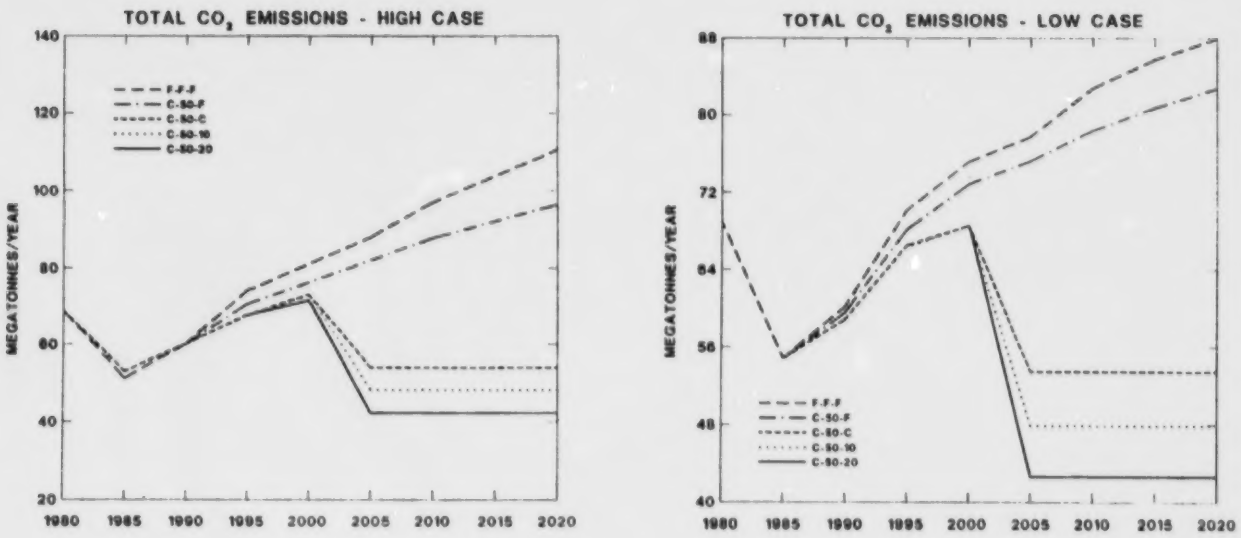
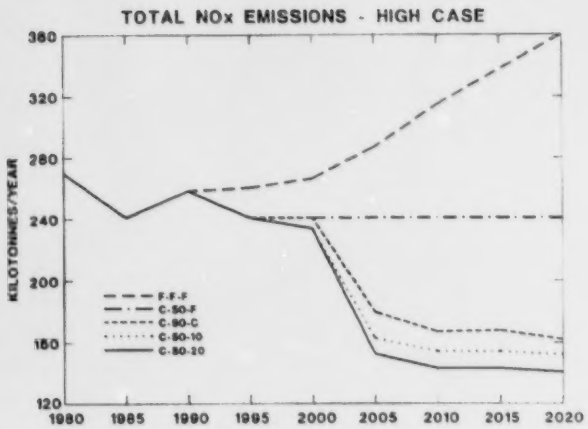


Figure 2: Total CO_2 Emissions for Quebec



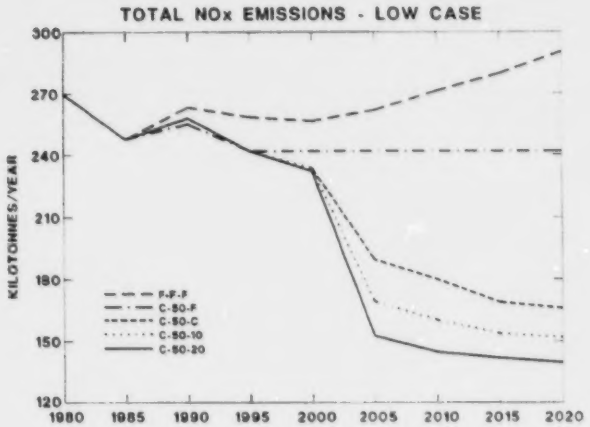
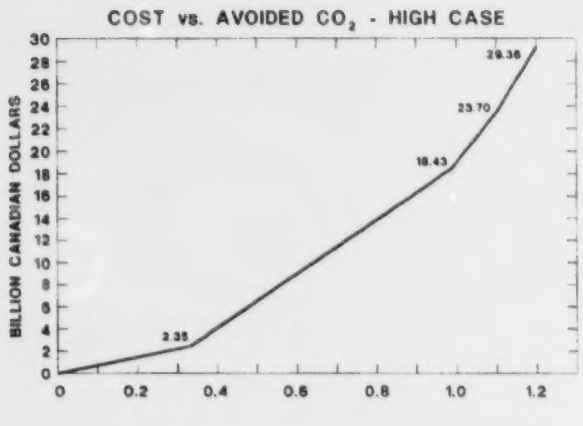


Figure 3: Total NO_x Emissions for Quebec



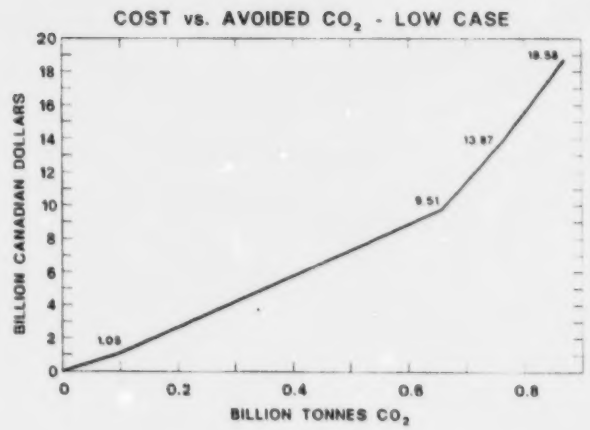


Figure 4: Costs of Avoiding CO_2 for Quebec

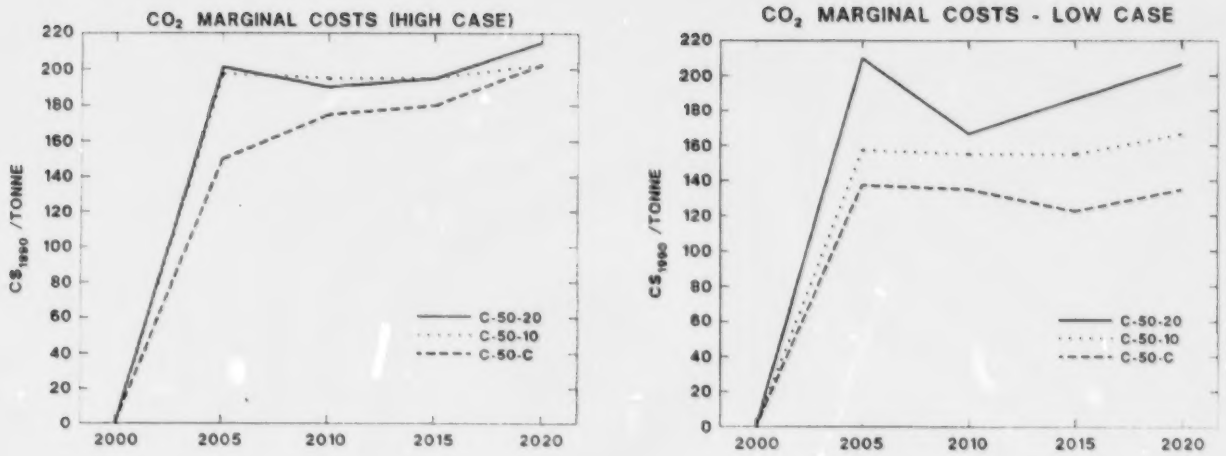


Figure 5: Marginal Costs of Avoiding CO_2 for Quebec

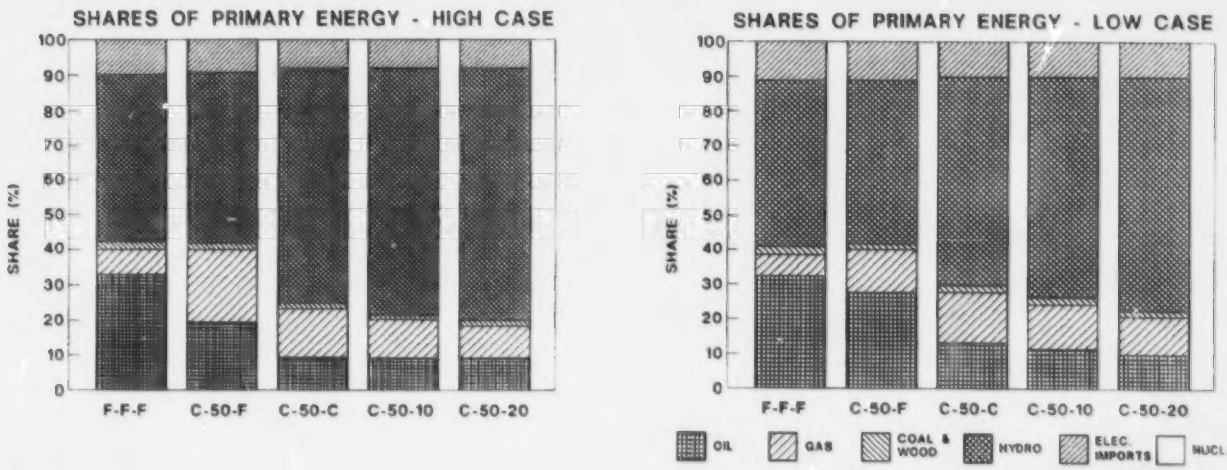


Figure 6: Primary Energy Shares for Quebec

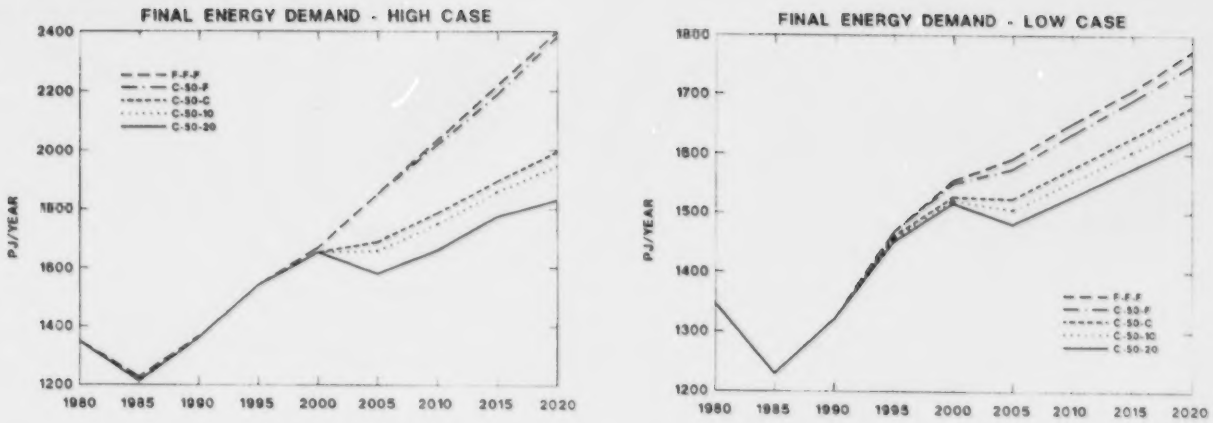


Figure 7: Final Energy Demand for Quebec

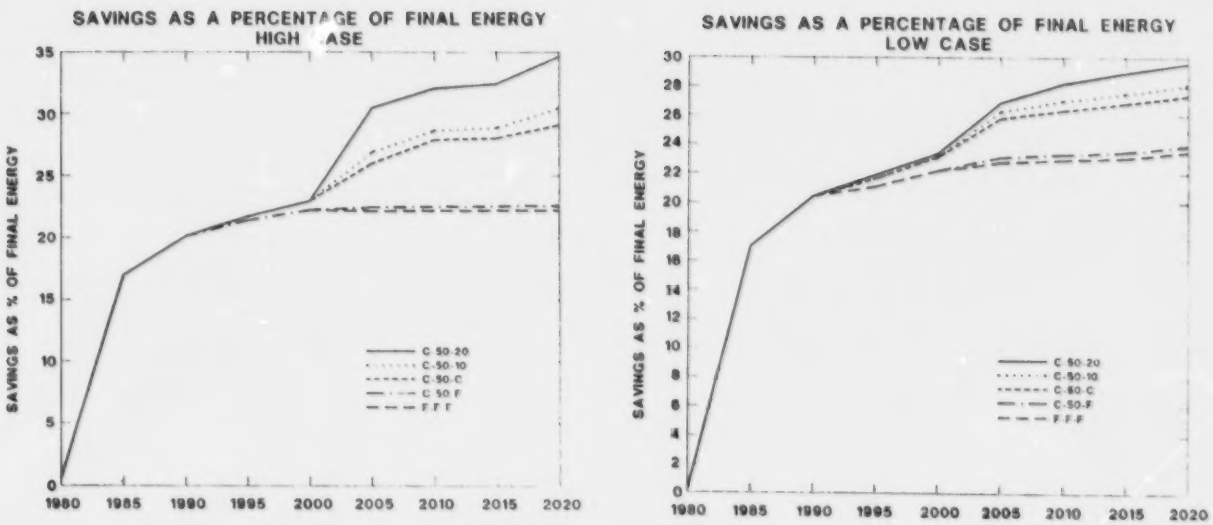


Figure 8: Savings as a Percentage of Final Energy Demand for Quebec

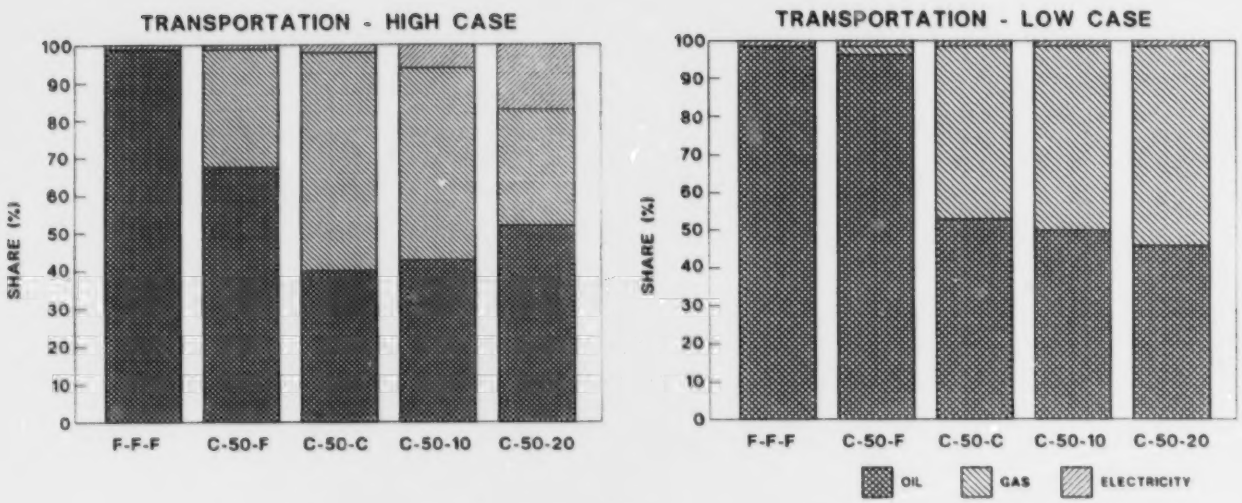


Figure 9: Transportation Shareby Energy Type for Quebec Under Various Scenarios

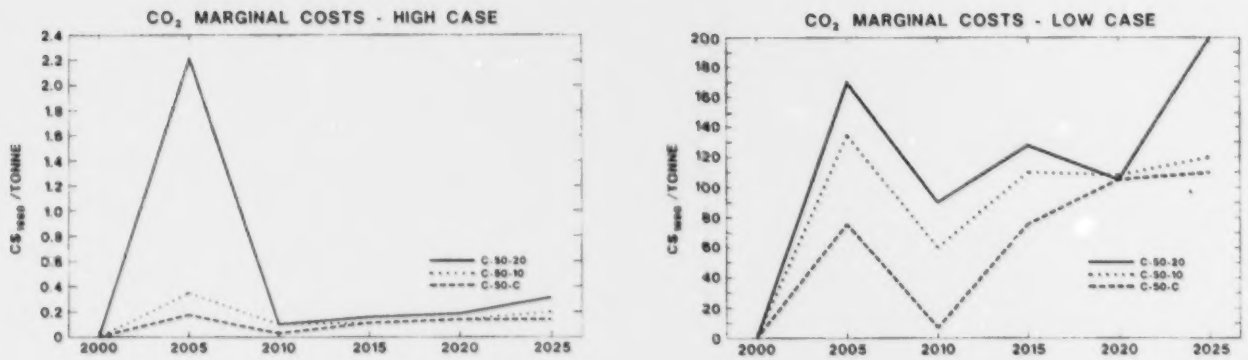


Figure 10: Marginal Costs of Avoiding CO_2 for Ontario

Panel Discussion: Western Canadian Energy in a Global Context

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Remarks by John Foster

Ladies and gentlemen, I have some announcements before we resume with the Forum activities.

There are a few groups here that I would particularly like to recognize and welcome. They are representatives, both students and teachers, from the following Victoria schools: Lambrick Park, Oak Bay, Reynolds, and L'ecole Brodeur. The students and teachers from these schools will be participating in the discussion groups, which are scheduled for this afternoon and tomorrow. And I've been asked to recognize Lindsey Nelson from Kamloops. We think Lindsey is the youngest participant ever registered at one of the B.C. Hydro Energy Forums.

You are invited to attend the Global Warming and Climate Change workshop, to be held tomorrow, on Tuesday, 12 May, from 7:30 p.m. to 10:00 p.m., here in the Conference Centre. Tickets are complimentary and are available at the registration desk.

There's one other thing I should like to do before we resume. B.C. Hydro is going to present a gift to each of our speakers and panellists at this conference, and here is an example. It's a numbered print of local Salish artwork done by Susan Point. I think you'll agree it's a very beautiful print to take away from the Forum.

Introduction of Judith Myers by John Foster

The next session of Energy Forum '92 will be a panel discussion on 'Western Canadian Energy in a Global Context' Our moderator for this discussion will be Dr. Judith Myers.

Dr. Myers is a Professor in the Department of Plant Science and Zoology at the University of British Columbia where she is also an Associate Dean of Science and of Agricultural Science. Her teaching encompasses insect ecology, biological control, ecological genetics and conservation ecology. She conducts research in these and related fields. Dr. Myers holds a Bachelor of Science degree from Chatham College (Pittsburgh, Pennsylvania), a MSc from Tufts (Medford, Maine) and a Ph.D. from Indiana University. She was a Miller Post-doctoral Fellow at the University of California at Berkeley.

I am not sure which of these particular skills, perhaps it's biological control, that she will be drawing on to run this panel. Judith, I turn it over to you.

Panel Discussion

Western Canadian Energy in a Global Context

Moderator: Judith Myers

Associate Dean of Science, The University of British Columbia

Panellists
Murray Fraser
Ian Smyth
Giacomo Capobianco
Bill Gatenby

Introduction of Panellists by Judith Myers

Ladies and gentlemen, I'm very glad to be here today. I am sure that in my introduction the name Chatham College may have meant nothing to most of you, but you may be interested to learn that Chatham College is where Rachael Carson took her degree, and so I feel that I am following in her footsteps.

I would like to acknowledge the support for women in science which B.C. Hydro has shown over the years. They have supported, through the Society of Canadian Women in Science and Technology, programs that help encourage women to go into science and technology and we at UBC very much appreciate their help.

As I look over this audience, which must be over 99 percent male, I realize that one almost totally untapped source of energy in Canada is women in the energy field, and I hope that in ten years time if one looks out at this audience that there will be a lot more women occupying these seats.

It's my pleasure today to introduce four speakers who will give short presentations, of five to ten minutes in length, followed by questions from the audience. Questions may be directed to the earlier speakers as well.

To start things off, our first speaker of this session is Mr. Murray Fraser, who is Senior Vice-President of Manitoba Hydro. In over thirty years with the company, he has held a variety of positions in engineering and related technical fields, administration and finance. He has served the Engineering Society of Canada and the Institute of Electrical and Electronic Engineers. Mr. Fraser is a past Director of the Canadian Standards Association and a member of the Standards Council

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Western Canadian Electricity

Thank you, Judith. To try and put western Canadian electricity into a global context in a very brief time, I'll discuss electric production and consumption, give you some information on installed capacity and prices, and I will touch briefly on the themes of Energy Forum '92: Efficiency, Trade, and the Environment.

1. Canada's Ranking in the World

As David Scott has already pointed out, electricity is actually a currency. Although it's not a primary form of energy, I will be treating hydro energy as one of Canada's primary resources in my remarks.

In a ranking of world annual per capita production/consumption data, western Canada comes very close to the top of the list. Canada itself ranks second only to Norway in per capita consumption. The western provinces are not quite as consumption-intensive as the rest of the country, but would probably still rank slightly ahead of Sweden, the country in third place.

Canada's total installed generating capacity ranks fourth among nations. Considering hydroelectric capacity alone, we are in third place. Canada's hydro plants annually produce more energy than the hydro-electric capacity of any other nation. A little more than one quarter of our capacity is in western Canada but it's interesting to note that even there,provincial capacity ranges from roughly 90 per cent hydro to 90 per cent thermal.

Another reference to global position is price to the consumer. Whether one considers residential, commercial or industrial customers, prices charged to consum-

ers in western Canada compare very favourably with the prices in other OECD countries.

2. Efficiency

The industry is stressing improved efficiency, both for itself and for its customers. All of the major utilities in western Canada are members of Power Smart Inc., which was started here in British Columbia by B.C. Hydro, and which is now active internationally. Power Smart activities are aimed at modifying the electrical demands that customers place on the supply industry. These programs provide a double benefit in that they improve the efficient use of the energy supplied, and by so doing, they reduce, or at least delay, the need for additional more expensive energy sources, thereby providing an environmental benefit.

The industry also provides assistance to its customers in energy use analysis and recommends the adoption of more efficient equipment and processes. Research and development of more efficient end-use devices is encouraged and incentives are provided for the use of more efficient devices and processes. Incentives are also provided to customers to increase their energy efficiency in buildings and building systems.

At the same time, the industry is continually striving to become more efficient itself by maximizing the efficient utilization of resources and minimizing losses. Efficiency gains must be economic as well as technically feasible in order for the utilities to continue providing favourable prices to customers.

3. Electricity Trade

Electricity trade between Canada and the United States is nearly 100 years old. Electricity exports characteristically represent less than 10 per cent of Canada's energy exports on a gross basis, but they have occasionally reached almost 16 per cent on a net basis.

In the national production context, the amount of electricity traded is not particularly significant. The maximum in any one year has been less than 10 per cent of Canadian production and about 1.5 per cent of the US production. With respect to individual utilities, exports in a single year have been as high as 40 per cent of domestic generation, but because the source of exported electricity is predominantly hydroelectric generation, the quantities vary dramatically from year to year, depending on the available water supplies. For a good part of the 1980s, Canada was a net exporter of over 1 billion dollars of electricity per year, but in 1990, Canada was a net importer of electric energy, in dollar terms.

This variability makes international ranking difficult but it can be said that Canada will normally be among the top five nations relative to trade in electricity.

Because of the variability, exports have historically been largely 'interruptible' as opposed to 'firm'. This pattern has been changing over the last 30 years as the emphasis has swung more towards firm exports, and the rate of change has been accelerating. Obviously, there is a limit to the amount of firm export available from a predominantly hydroelectric system; the amount of interruptible energy available for trade is also a function of prevailing water conditions.

This international trade is expected to continue with an increasing number and variety of transactions including economy energy, firm energy, firm capacity and capacity exchanges, energy storage and transmission. I am not sure that the total quantity of energy interchanged will increase, but the number of transactions and the variety probably will.

Another aspect of international trade is technology transfer. Western Canadian utilities are involved in numerous projects in developing countries aimed at providing assistance and training in the application of technology as those countries expand and upgrade their systems.

4. Environmental Impacts

The third topic of this Forum is the Environment. Electric utilities are responsible for providing an essential service reliably, safely, and at favourable prices. It is also necessary to provide this service with allowance for contemporary values of society with respect to environmental impacts. These requirements frequently conflict. Trade-offs and compromises are necessary to meet all requirements.

In a number of cases, utilities have been involved in the evolution of new environmental assessment processes. Any project that is expected to have a significant impact will be the subject of public consultation and discussion. Where the expected impact is deemed unacceptable, arrangements are made to avoid that particular impact, if possible. Where total avoidance is not possible, mitigation measures are undertaken to eliminate, ease, or compensate for the impacts.

Electric utilities in western Canada are involved in many research activities intended to reduce the environmental impacts of all aspects of their operation. Comprehensive emergency response procedures and environmental audit procedures have been developed. Considerable effort goes into educational efforts for staff, for students and for the general public.

5. Conclusion

The electric utility industry in western Canada is fully immersed in the global context. It is providing an essential service to an articulate and demanding society, and is fully cognizant of its responsibilities with respect to the environment and the expectations of future generations.

Thank you.

Judith Myers: Our next speaker is Ian Smyth, who is President of the Canadian Petroleum Association (CPA). In that capacity, he directs the staff of the CPA and represents the organization in its dealings with government, the media and the public. He was formerly a member of Canada's Foreign Service, with postings in Australia, Zimbabwe, Kenya and Great Britain. He was also Assistant Secretary of the Canadian Federal Treasury Board. Mr. Smyth has taught at universities and management schools in Canada and abroad, and has represented the petroleum industry on a wide variety of boards and national task forces. Ian will speak on the outlook for Canadian oil and gas in the international energy scene. Mr. Ian Smith.

Canada's Oil and Gas

Thank you very much and good morning. I am very pleased to be part of Energy Forum '92 here in Victoria today.

Our theme of 'Efficiency, Trade and the Environment' is particularly timely, as we are on the eve of the United Nations Conference on Economic Development in Rio de Janeiro. I think everyone has heard of the preliminary discussions between developed and undeveloped countries which are leading up to the Rio exercise, particularly with regard to industrial growth and environmental controls.

1. Background

To put oil and gas in a global context in the future is difficult, given the factors raised and the stalemate which currently exists with respect to who pays and how much we are going to be using over time. Certainly, there is still much to discuss within the global realities we know now; one of those realities is that oil and gas will be the world's most important fuels for many decades to come.

Our subject this morning is 'Western Canadian Energy in a Global Context'. Let me begin by putting that in a regional context. A secure economic and environmentally acceptable supply of energy is the cornerstone of the economies of western Canada and the fact that we export gas and are almost self-sufficient in oil is of profound benefit to Canada as a whole. After all, Canada's primary energy consumption comes about 40 per cent from oil and 27 per cent from natural gas.

While our oil exports are declining, our natural gas exports will continue to rise. We do have the world's largest energy consumer right next door and have a free trade agreement in place. With that market available, and our vast resource potential, this country's petroleum industry potentially has a very promising future.

Between 1986 and 1991, oil and gas exports contributed 25 billion dollars to Canada's income, which during that period enjoyed an overall trade surplus of 16 billion dollars. So one way of looking at that is to say that the oil and gas exports accounted for the entire trade surplus plus another nine billion dollars. Natural gas, of course, has been one of Canada's most important export commodities for decades, and if the industry can develop the necessary markets at competitive prices and control the predatory habits of some people in California who regulate our trade, we will probably be able to increase our gas exports well into the next century.

2. World Market

While most of Canada's energy exports go to the United States, there are other potential markets we can look to. We, of course, already have had some success in marketing bitumen to the Pacific Rim and to Europe. It is not too far-fetched to suggest that perhaps we can develop facilities to market liquefied natural gas to Pacific Rim countries at some future time. In fact, as you know, proposals to do just that were on the table less than ten years ago. Then economic realities asserted themselves and everything was put on hold.

From a different export perspective, our petroleum technology and technical specialists are in high demand world-wide. For example, in Russia and the other CIS countries, technology and 'know-how' is desperately needed and we are uniquely placed to provide those. To export technology, engineering and expertise suggests exciting opportunities in high-end knowledge exports.

3. Future Supply

On the supply side, Canada's potential supply of oil and gas remains vast. There is, in the Alberta tar sands alone, a petroleum resource greater than all of the established reserves of the Middle East. In fact, more than double that amount. However, much of our oil potential is found in unconventional form, such as bitumen in the oil sands. The size of the resources presents us with technological opportunities. The challenge is to make those high-cost resources compete with lower-cost production from elsewhere.

In a quiz that I often conduct with our friends in the media, I ask them what the average well in the Middle East produces and they never know. Well, the answer is around 7000 barrels a day; and then you ask what wells in Canada produce, and they say, maybe 3000 or 4000 barrels a day. The answer, of course, is 30 barrels a day, so we are at a considerable economic disadvantage with the people who are setting the price in the Middle East.

Nevertheless, we also have abundant supplies of natural gas. Prices today reflect the abundance of natural gas and the ability of the industry to deliver it. But the remaining potential is large, and major discoveries still

beckon. As recently as a few weeks ago, in the northeastern corner of British Columbia, a gas discovery of approximately 7 trillion cubic feet was added to our established reserves. But many of our major natural gas markets require expensive long-distance transportation systems, and, as with oil, much of the gas remaining is high-cost and poses environmental challenges which brings me to the ever present issue of environment.

4. Environmental Protection

I say with some pride that the oil and gas sector has been in the forefront of developing policies and practices to protect the environment and maintain work and health and public safety. A few years ago, our industry, the Canadian Petroleum Association in particular, adopted the first environmental code of practice developed by anyone in Canada. It is one which our members subscribed to over five years ago and abide by today. We recognize that society demands continual improvements in the quality of life and that people increasingly expect industry to produce commodities without compromising the environment. That is a tough assignment, but our industry does believe that we can and must integrate environmental goals with economic goals and we will do so.

5. Reducing Global Environmental Impacts

We also remain concerned however, about the difficult balance in developing countries between achieving industrial growth and in protecting the environment, and others have touched on that. What many environmental strategists point out is that the most effective way to deal with global environmental issues may be to put money into pollution controls in developing countries rather than to invest in more pollution controls in the industrialised counties. Now, for some environmentalists that is anathema, since I think they expect us to lead the world in emission reductions, but the fact is that in terms of 'bang for a buck', we really believe that emission controls in Canada are already so stringent that new investment in those areas will reap diminishing returns. Whereas by contrast, in countries like China, for example, which are heavily dependent on industrial facilities with inefficient or even non-existent emission controls; good opportunities exist for investment.

If you look at the question globally, where would it make more sense to put money if we want to reduce carbon dioxide emissions? To me the answer is clear, helping developing countries develop better emission controls could reduce emissions by orders of magnitude for the same environmental dollar. It is an option policy makers must consider, and one which was presented by a group of energy associations to Ministers in Ottawa as recently as two or three weeks ago. The point that I am making is simply that Canada has vast oil and gas resources which contribute greatly to the economy. That's positive and upbeat.

6. Economic Realities

Let me now turn to the dark side which is simply that the oil and gas industry in Canada is in a financial crisis. The realities are forcing the industry to restructure, to downsize, to work with all stakeholders in an attempt to secure long-term health of the industry. Until we become healthy, we remain shackled. As an industry, we are now realizing only a small part of our potential. Much in the future depends on how successfully we can rebuild our economic health. In that context there are many stakeholders, not the least of whom are governments.

Thank you very much.

Judith Myers: Our next speaker is Giacomo Capobianco. He is President and Chief Executive Officer of the Coal Association of Canada. He has spent his entire career in the mining industry, in positions ranging from underground miner to president of mining companies, from field exploration geologist to manager of international exploration. Dr. Capobianco was formerly Vice–President, Coal, of Esso Resources Canada Ltd. and Chief Executive Officer of Byron Creek Collieries. He is a member of the Canadian delegation to the Coal Industry Advisory Board of the OECD, a director of the Canadian Energy Research Institute and a member of the advisory committee to the Canadian negotiating team on the World Climate Change Agreement. Dr. Capobianco.

Coal in Canada

Ladies and gentlemen, I am sure most of you are aware of the tragedy that has struck our industry, the Westray Mine disaster in Nova Scotia. Eleven men have already been found dead and fifteen are still trapped underground. I have no further news from that event to report to you this morning.

Those people were just as much a part of the energy industry as anyone in this room. I would ask you all to observe a moment of silence and perhaps offer a prayer for their successful rescue.

1. Coal Production

Canada is the fifth largest exporter of coal in the world. Coal mining is BC's third largest industry. It's also the safest sector of heavy industry in this province. The industry as a whole contributes about 2 billion dollars each year to Canada's export surplus. We have a total impact on the Canadian economy of about 3.7 billion dollars a year. We export about 30 million tons of coal a year to Asia, to Europe, to Japan in particular, to Central America, South America and we even export

coal to Newcastle. Coal is our largest single export to our second largest trading partner, Japan.

Domestically, about 20 per cent of Canadian electricity is generated by coal, second only to hydroelectric. And it's done very efficiently and very cost effectively. For example, over 90 per cent of Alberta's electricity is generated by coal and Alberta has power rates are among the lowest in Canada. 80 per cent of the remaining fossil fuel resources of this country are coal, even taking into account our huge reserves of heavy oil.

Guess what, though? We are a small player in the world's coal business. Canada's coal reserves are only about two per cent of the world's reserves. We produce 70 million tons a year. The world currently uses 5 billion tons of coal a year. That's equivalent to about 13 billion barrels of oil. So why are we in the play at all? Well, we are very well set up to export in the sense that we have coal which is reasonably close to ports and our coal is of a quality that is desired in the export market and we have other internal markets in Canada. As this panel has told you, we are rich in energy resources. We have coal that is well situated to supply local domestic demand, not across the country, but certainly in key parts of it.

Well, what does that world annual consumption of five billion tons of coal do for humanity? It produces about 30 per cent of the world's primary energy. It is second only to oil, which supplies about 38 per cent. It produces over 40 per cent of the world's electricity and it's used in the production of well over three quarters of the world's steel.

2. Coal Production to Grow

So now let's take a look ahead. We've got five billion people on the planet now. On a 'business as usual' scenario, the forecast is 8 billion by 2025; and in the latter half of the next century, 14 billion. By 2025 Africa's population is going to be equal to that of Europe, North America and South America combined. So what's that going to mean in the energy field? Obviously an increase in demand for energy, a demand multiplied by the process of industrialization, by the process of trying to improve the living standards of all of those people.

Obviously, there is a strong correlation between per capita income and energy consumption and in fact there is even a strong correlation between per capita use of energy and longevity. The result, as I think we all recognize, is that there are going to be tremendous demands on the energy sector. One result of that is going to be a massive increase in coal use on a world-wide basis. That's demonstrated for example, by the fact that in the last ten years, 40 per cent of all new electrical generating capacity world-wide has been coal-based. Most energy analysts will agree that by early in the next century coal is going to surpass oil as the largest single source of energy in the world.

Why is that? It's got a long history, it's a cheap source of energy, and it's plentiful. Interestingly, the figure of 80 per cent of world resources being coal parallels our Canadian situation. Globally, coal is very widely distributed so there isn't going to be any 'Coalpec.' Coal is simple to use. It is not a very sophisticated technology, so any change away from coal, I believe, is necessarily going to be slow.

3. Coal Consumption in Developing Countries

There are other priorities facing most of these countries and I believe that's one of the issues we have seen, if not faced, in the climate change negotiations. The issues of food and water and sanitation and decent living conditions are much further forward in the minds of the people in the developing countries than something as esoteric as climate change. But we have to make sure that when this growth takes place in energy use and particularly with coal, that it's done in the best environmental fashion. And today, as Ian mentioned, in China and India and in eastern Europe, the combustion efficiency and the control of combustion emissions from all forms of energy, especially coal, is pitifully low; that's where the opportunity exists for us as North American business people and for our North American companies.

There will be markets for further exports of Canadian coal. What we've got to find is a cost-effective, fair and socially effective way of making sure that the developing countries don't go through the same cycle that we have, but rather that they come onto the technology curve further up. That, again, is a key issue in the climate change negotiations.

4. Coal Technology Transfer

We could transfer the latest technology to them and that's one of the keys they insist on, the very best available technology. I don't agree with that, and I'll tell you why in a moment. We have a great deal of advanced technology to offer. Canada is very good at that. Would you like to see a 30 per cent reduction in world CO_2 emissions? Find a way to transfer to the developing countries, not the new leading-edge technology, just the technology we are using in this country today. Get China and India and Eastern Europe to use that technology and you'll get a dramatic reduction in CO_2 emissions.

We have seen a 400 per cent increase in efficiency in the use of coal for power generation since 1900 in this country. It is continuum, it's an improvement curve that goes on beyond the levels we are now, from about 35 per cent efficiency, up to the 60 and 70 per cent efficiency levels with technology that is being examined today.

Whether or not that will happen depends largely on whether the governments and people of Canada recognize the asset that coal is, recognize the huge role coal will undoubtedly play on the world scene and encourage it rather than discourage it. Will governments encourage research into how to use this tremendous

asset effectively for the country's benefit or are we going to tax it to death? That question is still on the table.

5. Conclusion

My conclusion is that coal is playing a big role today domestically, and worldwide it's going to play an even bigger role. Canada, in that framework, will play a moderately large role, which will be important for this country. We will continue to be exporters and we hope to grow in that market. I hope that we will continue to use coal domestically; it depends what our government policies are, and I hope that we will recognize that there is a place for Canadian leadership in advancing clean coal technology in the developing countries.

Thank you.

Judith Myers: Thank you, Giacomo. Our final panellist this morning is Mr. Bill Gatenby, who is Chairman of Cameco Corporation, and has also served as President and Chief Executive Officer of that company. Prior to joining Cameco, he was President and Chief Executive Officer of Texaco Canada Resources Ltd. Mr. Gatenby has served as a Director of the Calgary Saddledome Foundation, a member of the Audit Committee for the Board of Governors of the University of Calgary, and a past Chairman of the Canadian Petroleum Association.He currently is a member of both the Advisory Council on Science and Technology Innovation and the National Advisory Committee on the Minerals and Metals Industry. Mr. Gatenby was inducted into the Saskatchewan Oil Industry Hall of Fame in 1991.

In addition to these seemingly onerous tasks, I understand that he is also a farmer, and I think this adds another dimension to his background. Mr. Bill Gatenby.

Uranium Production in Canada

Thank you, Judith. It's a pleasure to be here this morning. Actually, I just finished seeding my farm in Saskatchewan, and if you want an example of global warming, it was 92 degrees out there last week. Pretty unusual for early May, so maybe something's changing.

Ian, I am sorry to hear that prediction from the Coal Association that puts the petroleum industry down to second place in the next century. I guess we are in third place and trying.

1. Global Environmental Considerations

Last December, the Quinshan nuclear power reactor near Shanghai began operating and thus became the first nuclear plant in China to generate electricity.

With a society of 1.1 billion people who depend on coal for about 70 per cent of its energy needs, China is the largest coal-consuming country in the world, burning some 900 million metric tonnes each year. It also ranks, unfortunately, as the most inefficient country in the world in terms of carbon dioxide emissions per unit of gross natural product. France, on the other hand, produces the least amount of greenhouse gases per unit of economic activity because almost 75 per cent of its electricity supply is nuclear-generated. The French emission reduction program has, indeed, been the envy of Europe.

As the Chinese economy develops, and it will; and it continues to rely primarily on coal, and it must; predictions are that China's CO_2 emissions, as well as ash and sulphur dioxide emissions, will continue to grow rapidly. So, what we have on our hands is not just a Chinese environmental problem, but a global environmental problem in this shrinking world.

Chinese nuclear generating capacity is now expected to reach 6,000 megawatts by the year 2000, representing a modest 2 per cent of the country's output. Through this first step into nuclear power, the Chinese will be displacing about 36 million metric tonnes of waste each year which would have otherwise gone into the atmosphere.

China's heavy dependence on coal and it's more recent decision to start using nuclear power demonstrate clearly how energy choices have the capacity to touch the whole human race.

Certainly, one can't suggest that the Chinese stop burning coal and build nothing but nuclear plants in future. I think it's a problem that will be improved with better stack management, better quality coal at the right place and some nuclear, some oil and some gas but it does demonstrate that there is more than one solution.

2. Uranium Production in the Future

So when you ask me whether I see an important role for uranium in our energy future, ladies and gentlemen, the answer is clearly 'yes.' China is just one more reason for my view that this valuable and abundant western Canadian resource must play an ever-increasing role in meeting the world's baseload of electricity requirements.

Today, about 17 per cent of the world's electricity is generated by nuclear power, compared with 10 per cent for oil, 12 per cent for natural gas, 19 per cent for hydroelectric and 42 per cent for coal. Certainly, there is a continuing and important role to be played by all of these fuels. But as the world tries to minimize the environmental damage caused by the use of fossil fuels and as these non-renewable resources are depleted, we must look at all options and I would include nuclear. I should add that with the re-processing technology available today, you might even consider uranium, in a sense, to be a type of renewable resource.

With more than 420 nuclear reactors operating around the world and another 76 under construction, nuclear technology does indeed offer a proven, viable energy option. With an abundance of reserves to sustain it's use for decades to come, Canada is in a strategic position to capitalize on the increasing development of nuclear technology.

Here in western Canada, and particularly in Saskatchewan, where our company is based, we have some of the world's largest and richest uranium reserves. Uranium ore grades in Saskatchewan are about ten times richer than those found anywhere else, making our uranium mining operations more efficient and less costly. Compared with other mineral fuel sources, Canada's current uranium production accounts for about one-third of this country's total equivalent energy fuel output, with petroleum, gas, and coal sharing the rest. As a former oil man who joined the uranium industry four short years ago, I'm often amazed at the understated significance of this useful, efficient and valuable fuel.

3. Uranium Mining in Canada

Now, I'd like to very briefly talk about my company, Cameco, which is only four years old, and where it fits into the world's energy picture.

Cameco is Canada's largest uranium producer. In this industry, when you are the biggest in Saskatchewan or in Canada, you are also one of the biggest in the world because our country produces about one-third of the western world's total output of uranium concentrates. Canada's uranium production is about 3 times that of the United States and about 2.5 times that of Australia.

Canada's uranium production also translates into a very important contribution to our national economy. Even with a sharply depressed uranium market, the total value of Canadian uranium shipments in 1990 was about 880 million dollars. About 70 per cent of that was in the form of exports, 615 million dollars. Actually, the only province in Canada that uses uranium significantly is Ontario, which generates a little more than half their electricity from nuclear plants. For once, I must admit that Ontario is leading the way in good thinking and common sense, even though, as a westerner, I find that awfully tough to admit.

My home province, Saskatchewan, accounts for more than 80 per cent of Canada's uranium production, and our company, Cameco, is responsible for about 60 per cent of that. With about one billion pounds of uranium reserves in Saskatchewan, half of which belongs to Cameco, our province is often referred to as the Saudi Arabia of the uranium industry, and producers like Cameco are in a very good position to take advantage of any growth opportunities.

We have the large, well-situated, low cost reserves. But, of course, the single biggest problem with uranium is image (as Ronald Reagan will tell you). Despite what we think is an overall superior record as a safe, efficient and environmentally-sound method of producing electricity over the past 35 years, nuclear power and all businesses associated with the term 'nuclear,' continue to carry the stigma of an industry conceived in war.

Most recently, critics have pointed to Chernobyl as a reason to reject nuclear power. That incident in 1986 certainly and properly heightened public awareness of nuclear power operations and did force a careful reassessment of nuclear energy in general. However, nuclear power has endured as witnessed by the facts that the 26 countries around the world currently have nuclear power programs. Half of them generate at least one quarter of their electricity using uranium. Other countries, such as Italy, are now reconsidering the moratoriums which they placed on nuclear power in the past.

4. The Lesson of Chernobyl

When Chernobyl prompted a review of nuclear power, it also ushered in the decade of the environment, in which each and every single source of energy is – and should be – carefully scrutinized in the same manner that once seemed reserved for nuclear power alone.

As all of our energy choices are being stacked up beside one and another and measured using the same yardstick, we think that nuclear power is emerging as a safe, efficient, and cost-effective source of electricity. When I joined Cameco after more than three decades in the oil industry, I thought I knew a fair bit about energy but I found out I knew a lot less about uranium. I have come so far on this issue that I would now like to refer to uranium as the 'green' fuel, not because of its stereotypical Hollywood image of radiating a greenish glow, but rather because uranium is environmentally friendly and safe.

5. Nuclear Industry Safety and Waste Management

We certainly are regulated. We are regulated at both the provincial and federal level and I think if the public knew all of the facts, the largest complaint and concern they might have is over-regulation.

Safety and waste management issues have been tackled and technically resolved. Given the nuclear industry's overall track record, especially here in Canada, it seems to me inexcusable that many of our policy-makers take cover behind the shield of one public review after another in order to avoid making some critical and long-overdue decisions about a very important energy fuel.

There will come a day when we will have to pay for their reluctance to make choices. In the meantime, I think the willingness to get together and look at all our energy options fairly at public Forums like this is the sign of a good first step forward. I think a lot of people misunderstand us in the energy industry.

While we compete, we all recognize that the world needs all sources. There is certainly no question that oil is by far the preferred transportation fuel, gas is certainly the most preferred heating fuel and coal and nuclear probably are the best for generating electricity. I think we have to plan their utilization properly. I think the world will see a shortage of energy fuel sometime in the future and will not allow us the luxury of waste.

Thank you very much, Madam Chairman.

Judith Myers: Thank you, Bill. Our first question is addressed to Giacomo and David. "Giacomo's forecast for coal growth is quite different from that of David Scott. I would like to hear David's comments on the reasons for coal's expected growth or lack of growth."

David Scott: First of all, I should say that I didn't prepare the forecasts shown in my slides.They were done by the International Institute for Applied Systems Analysis. See Figure 5 on page 33. They are historical trends of market share, and are based on ecological models similar to those mentioned by John Hollins, about bacteria on a Petri dish competing for an environment. The model doesn't give a reason why, it just says that the world has done this before with other fuels.

They've done a lot of tricks with backcasting and forecasting and have concluded that you really can't live with continued exponential growth for a long time.

Rather than say, "Why is it going like that?", I would say, "Since it has always gone that way, let's have a good reason why it would not."

But if you say, "Why, for an example, has natural gas not followed the trend of that line?" it's fallen a little bit below it. I think in some measure it's the natural gas industry's fault, since they allowed and perpetuated, and in fact, endorsed the mythology that we may run out of natural gas. So legislation came in the United States and in some sense in Canada which prevented gas from being used to generate electricity. And there are now combined-cycle technologies that can convert gas into electricity with very high efficiencies. So an in-place, state-of-the-art turnkey operation, running at 50 to 55 per cent efficiency, is now a distinct possibility.

I think the laws discouraging the use of gas for electric generation, based on the kind of silliness that we are going to run out of gas, are coming off, and therefore, I expect to see a rebound back upwards in gas use.

Let me say why I believe that coal consumption will decline in the future. Clearly, we are really into some gut issues here and some people are going to get angry. There was a lot of talk this morning about coal being the bridge to the future and I think we live by these sorts of things, these sort of phrases. But I doubt that it will happen. Certainly, we can have cleaner technologies but there's no meaning to 'clean' with regard to CO_2 except for increasing the efficiencies to reduce the amount produced.

I think that the CO_2 business is going to be really very, very troubling and I think that will be a stopper for coal in time. We may see all those curves falling down. Remember what we are talking about there is market share, not absolute quantity of use. So it's quite conceivable that even though the market share drops, that the quantity of coal will continue to rise for a little while.

Giacomo Capobianco: I would like to add a comment on that. I think the last point David Scott made is a key one. If you are talking market-share, I believe the same forecasts for which I gave absolute numbers would indicate market share for coal either staying about what it is, or dropping slightly, so I don't see a conflict there.

I would comment though that, and I'm sticking my neck out on this one, I really have difficulty in seeing how, in the developing countries, any other fuels but nuclear and coal can compete. Those developing countries that have natural gas, sure they'll use if they can, or they will export it as a means of earning hard currency.

But I don't see countries importing large quantities of natural gas to stuff into an industrial boiler. If they import natural gas, it will be for higher end uses. As far as the CO_2 issue is concerned, I might as well go on record one more time as saying I think we are going to be very surprised in ten years when we know more about what we are dealingwith on that issue. On the technology issue, as I mentioned, you can see it as a disadvantage for coal or you can see it as an advantage. The advantage is that we know the technology that's in use out there today is not advanced technology, it's not what we use in developed countries, and there's lots of scope for improvement. That's a real opportunity.

Judith Myers: A question to Ian Smyth: "Regarding the export of natural gas from Canada in the liquefied form, does it make sense to do this while much of the world is still flaring off its gas?"

Ian Smyth: The short answer is 'no.' But there's a whole lot of natural gas in the world. Indeed, LNG plants in the Middle East are likely to suck up a great deal of that market. But if we are to forecast into the next century as I think we meant to, it should be noted that as recently as 10 years ago, it was considered to be marginally economically viable to liquefy gas. But, in those nice days, Canada sold gas to the US for $US 4.94 per thousand cubic feet. Today, it's more like $1.20.

Judith Myers: Murray, here's a question for you. "Are there any major barriers to increasing electricity trade, what are they and can they be overcome?"

Murray Fraser: There are technical limits to our

ability to transmit electricity over very long distances. Research is continuing in this field. My prediction is that improvements will probably come relatively slowly. I would remind you of David Scott's slide that indicated hydrogen has an advantage over long-range electrical transmission on the Earth's surface. I have to agree with him on this point. Research, in my view, will extend that capability but I think it will come slowly.

Question: I am Bronwin Boulton from the Thompson Watershed Coalition in Kamloops. My question is for Bill Gatenby. Although global warming is a significant environmental issue, nuclear waste is even a more difficult issue. What is Cameco doing about nuclear waste?

Bill Gatenby: Cameco does not have any nuclear wastes. We are not in the generating business. We are the producer of the fuel. The industry, however, at this moment puts its radioactive nuclear waste, the bundles from the reactors, into Olympic-sized swimming pools, where the initial radiation will decay to tolerable levels in about 30 to 40 years.

There is a panel here in Canada, made up of federal and provincial representatives, who are studying the possibility of using deep burials for the waste in the stable granite of the Canadian Shield, either in Ontario or Manitoba. Many of us think this is the solution and that it is now feasible. This study will be subject to public hearings and a lot of further examination. The ultimate goal would be to put the nuclear wastes back into the ground where you would be facing far less exposure than you would if you are standing over our Cigar Lake uranium property in Saskatchewan, which, of course, is naturally radioactive.

Bronwin Boulton: I think that pure uranium in the ground is nowhere near as radioactive as spent uranium fuel from nuclear plants.

Bill Gatenby: If Stan Hatcher from Atomic Energy Canada is here, he may wish to answer your question. Stan, can you comment?

Stan Hatcher: Yes, I'd be quite happy to comment on it. I think the most important point about radioactive waste from nuclear power plants is that it's a very small quantity and it's contained. The wastes from 40 years of operation of Ontario's nuclear plants all goes into a swimming pool with lots of room to spare. Nothing is released to the environment. And that is one of the advantages of nuclear power.

The current process that's going on through the Federal Environmental Review Panel will probably be completed by about the mid-90s, I believe. That should give, not only the scientific and engineering evaluations, the evaluations of the feasibility of burial in the Shield, but also, as Mr. Gatenby said, an opportunity for a considerable amount of public debate on the whole issue. So I think you are going to get a good, fair and justifiable hearing before the public, and I think the result will come out fine.

David Scott: Could I make just a comment because I hope I am neutral to sources, but I would just say that whenever we talk about nuclear waste disposal, we also have to think about fossil waste disposal and we are not doing anything about that. There are no technical means of collecting CO_2 and putting it down a mine, and my feeling is that there is no question but that the fossil waste disposal will ultimately place planet Earth in severe jeopardy, severe jeopardy.

There is a lot of talk about the jeopardy of nuclear waste disposal. I think, in fact, the risks will turn out to be tolerable. I will say one other thing. For an integrated plan of nuclear development which includes breeder reactors, recycling and that sort of thing, studies indicate that the exposure humans, animals and plants face from uranium radiation will actually decrease after about a hundred years. Because you are mining the uranium out of dispersed deposits all over the place, where you don't really know where it is, and it's leaching into rivers, etc., the exposure is currently high. That's particularly true as the first deposits you go after are the high grade ores by definition. After it is spent as a fuel, you take all this dispersed natural radioactivity, and ultimately bury it all in one place that is a thousand meters deep in solid rock. In fact, the total world exposure to radiation from uranium will probably go down.

I think these things should be pointed out sometimes.

Judith Myers: The next question is for Hollins and Scott. "The problem with looking at energy services is that many are supplied by unregulated companies whereas suppliers of 'currencies' are typically regulated. We cannot afford to have more industry regulation by inefficient bureaucracies. How can we price environmental externalities in energy services without crippling industry with even more administration?"

John Hollins: I think that the plea that the environmentalists made 15 – 20 years ago, and the position which David Scott and I recommended this morning, is to recognize quite bluntly that nobody wants energy for energy's sake. What we **really** want, as Amory Lovins put it, is a cold beer and warm shower. And David Scott is right, but he doesn't go quite far enough! He suggested it doesn't matter what source of energy we use; I suggest it doesn't even matter what currency is used.

Traditionally, in the energy business in Canada, and in the rest of the world as far as I know, we start by thinking of our energy resources and how to promote their use. Some of our distinguished panellists here this morning are in the business of making money by selling

energy resources, and quite properly, take that point of view; note their contribution to the Canadian economy.

However, if we look at our existence as part of an ecosystem, we'd better stop and think how many individuals of our species, how many resources per person are we going to use and come at it from that end. There's all kinds of potential for regulation in our myriad levels of government in this country, but I do not think that is yet germane. We really must collectively figure out that we are all concerned with balancing energy budgets, not just supplies of energy, and then apply a range of measures, not limited to regulation, to help human society to live in harmony as part of its ecosystem.

David Scott: A couple of very quick points. First of all, there are externalities. We will have to internalize them, and it will be difficult. Some of these things are particularly easy. Take CO_2, for example. It may be difficult to know what the ultimate effects of CO_2 emissions will be; but it is not difficult to count atoms going up a smoke stack, and so CO_2 would be very easy to regulate.

Other things would be less easy. I think that's all I would say, except for one other thing, by way of a quick little parable. At the turn of the century, we changed from coal oil lamps to electric light bulbs for illumination, and the change was not because we were running out of coal oil nor was it because it was cheaper, because only the most expensive homes could afford that change to electrification. Electric light was adopted because it was better; and it was better because it was more convenient, more reliable, safer and environmentally cleaner. And it turns out that whenever we want to clean the place up there are two fundamental ways to go at it. One is to add a collector to collect the bad stuff and the other is to change the process so you don't make the stuff. Almost always, we tend to add the collector first. That's the sort of mind-set jump. Almost always, the better way is to change the process so that you don't make it and I see a world evolving with these new technologies where we are really changing the processes and therefore there's a phrase that one of my friends, now deceased , used to say "Cleaner is cheaper." In the long term you'll find that that's true.

Cleaner is more expensive only when you don't change the process and you merely add a collector but when you evolve processes, it seems to go that way.

Judith Myers: Excuse me, If I could just make a point. Different people make a profit when you change the process and that, I think, may be the problem.

David Scott: Yes, different people make the profit.

Question: My name is Cecil Kelly, I'm from Prince George, representing the Nechako Environment Coalition. My question is sort of a shotgun approach to the whole panel up here. My first point is that Canada is not the backyard of the United States, nor is it a playground for the corporations of the world. Canada is not for sale.

My second point is that in transferring into a clean power – I am a supporter of hydrogen power – but if we were to pay the true cost of the energy that we are generating from gas, oil, coal or uranium, including all the environmental externalities, then hydrogen would be a more attractive energy source. My question to the panel is: 'How can we consider forcing or encouraging the people of B.C. to adopt the Power Smart program by turning off the lights and going to bed early, and take the energy we save and make hydrogen instead of exporting the energy to the United States ?'

Otherwise, once we've locked these exports into POWEREX's plans, we will have to do more damming of rivers to be able to get enough surplus energy so we can produce this hydrogen.

There is more hydrogen locked up in oil and coal. Why are we not using our new-found technologies for releasing this hydrogen and keeping this energy that we are so cavalierly exporting to the United States where they will probably use it to make their own hydrogen?

Ian Smyth: I'll volunteer a comment because I have been present at other meetings where people have asked representatives in the petroleum industry about hydrogen. Three companies that I know of who wouldn't mind their names being mentioned are Amoco, Imperial, and Shell. All of them are spending very large sums of money in a search for an economic means of producing hydrogen. The most recent answer I heard on that is about a year ago, so there may be new-found technologies to which the intervenors referred a moment ago, that I haven't heard of. But, as of ten months ago, there was no economic hydrogen technology. There is certainly hydrogen technology everywhere, but no economic hydrogen technology.

Now, the issue is whether we are going to internalize all those externalities and if we are going to go to full-cost accounting, then it's entirely possible that things that people in this room never dreamed of will become economical. But within the way that the world prices of these commodities are set at the present time, and I say the world and not Canada, because if we are going to adopt full cost accounting in Canada, and the United States is not, then we are dead.

And, believe it or not, we are not isolated. We are not citizens just of Canada, we have to be citizens of the world and of a world energy market where things that happen outside our country very dramatically influence what's happening within the country.

It is not unreasonable to make the assertion that we are not for sale but by the same token you had better not ignore the reality that we are in a world energy market.

And I happen to work in an industry where we found that out in a very painful way in recent years.

So if we are going to go to full cost accounting, then maybe hydrogen's a viable proposition. But if we are going to go to full cost accounting, I hope the rest of the world is going to be there too, because if it isn't, we are not going to be there for long.

David Scott: I fully endorse the proposition that we are not for sale. I think that too often it turns out that maybe we are for sale. But let's put that behind us.

As to the cost of hydrogen, let me put another slant on it. It depends on what are you using it for, whether it's economic or not. We can't fly to the moon without using hydrogen, but in fact, we use very trivial amounts of hydrogen to fly to the moon. Where we do use massive amounts of hydrogen is to upgrade heavy oils in oil refineries. I mean that's why, clearly in that sense, it is economic today, and it has been economic for a while.

If we didn't strip natural gas for hydrogen to upgrade heavy oils, we wouldn't be harvesting those heavy oils, so to me, it's a matter of economics for what use and in what systemic sense. I think the reason why hydrogen is not economic now as a transportation fuel is not that we can't produce hydrogen, because we can produce it fairly cheaply on an energy basis, but it is the lack of end-use technologies to exploit it effectively that send the costs go sky-high; that's the stopper right now.

John Hollins: The notion that we can just use some spare capacity overnight to make enough hydrogen to fuel our transportation is just not so. All you have to look at is the total quantity of energy that Canada uses for transportation and if you decided that it would be awfully nice to replace Mr. Smyth's industry by a hydrogen industry fuelled by hydraulic electricity, you'd find you'd have to double Canada's installed capacity for electrical generation overnight in order to do that.

We come back to what David Scott said earlier; hydrogen is an energy currency. You don't just go and mine it; first, you have to separate it from whatever other atoms are connected to it. You may have to put in more energy than you will eventually get back from either oxidizing the hydrogen in an internal combustion engine or a fuel cell.

Derek Davis: I just wanted to make a general comment because I have the advantage of being a foreigner, at least not necessarily focusing on B.C. My comment concerns the internalization of external costs, particularly environmental costs. And I do believe myself that we do, globally, have to go down that road if we are to make progress, real progress on the environment.

The point which Ian Smyth was making about Canada in relation to the US is a very familiar one in the European community. The real hang-up on the energy tax debate within the community is France. France is holding out, not surprisingly, for a carbon tax, because it doesn't produce much carbon and from their point of view it makes sense. I am not knocking them, I can understand their position. An energy tax, rather than a carbon tax, would be grossly unfair, because they have gone to all the expense of building a nuclear system that produces no greenhouse gases.

It's a worldwide problem, and I think we have to tackle it globally, not piecewise, but tackle it we must.

John Hollins: I've heard several people talk about internalizing environmental costs. That's a perfectly natural thing to do in a society which has had an industrial economy and a particular kind of economics. We want to think about things in terms of costs and benefits. But the plain fact of the matter is we have some environmental imperatives facing us and on top of that, we can't calculate the environmental benefits or costs in the same kind of way and in the same kind of units.

The only practical way that I can see of trying to bring the environmental considerations into some general calculus is **not** to try and make some inevitably arbitrary estimate of an environmental benefit or cost to go into some traditional economic equation.

The OECD and lots of other people have been trying to do it for 20 years. I submit that to date, they have failed and I don't see much prospect for anyone doing it any better in the future. The most pragmatic way of going forward on that kind of basis, I think, is to define an environmental requirement on the basis of the best environmental science available at the time.

We've done that in Canada already two or three times. We did it for emissions of acid rain precursors in the mid-80s with binding agreements between federal and provincial governments and companies and citizens responding to it. We've done it for CFCs and depletion of stratospheric ozone. For CO_2, we have the Toronto recommendation from 1988; the federal government is committed to stabilization. We can do some calculations, as I showed this morning, to define what the implicit economic cost of dealing with that is.

Judith Myers: Here is another question directed to the panel. "The Free Trade Agreement is globalizing our economy. How are environmental assessments going to be done – at the producers' factory, or where the products are consumed? Will Mexicans get the pollution from factories of American and Canadian subsidiaries located in Mexico, making products destined for consumption north of the border?"

Bill Gatenby: In the uranium industry, Cameco's largest customer is the US, so the free trade agreement obviously is good news if you want to export uranium.

John Hollins: I would only observe that just as Canada's 'Green Plan' preaches the integration of environmental considerations along with economic and social and all kinds of decision-making, that's clearly an approach that Canada is taking in international dealings. There is a lot of professional analytical work going on right now at the GATT, at OECD, and in other places because it is evident that trade could have significant impacts on the environment.

The preliminary analysis that I've seen suggests that with certain exceptions the direct impact of international trade on the environment is generally less than the impact of domestic economic activities and there could be both benefits and disadvantages.

Liberalization of trade would obviously have environmental benefits if it removed distortions in the market and allowed, say, for more efficient allocation of resources. I think there's no simple answer to the overall question of trade and environment; it's a new field of professional, analytical and very strong political interest. I think we can be sure, since the federal government is currently conducting a simple environmental assessment of the North American free trade proposals, that we'll see more and more of that kind of thing.

Derek Davis: Just to make the slightly oblique comment which I think does relate to some extent to what John Hollins was saying, one of the upfront points that developing countries make to us is the problem of trade barriers developed countries set up which interfere with exports from developing countries.

They argue, and I just quote it for what it's worth, irrespective of motivations, they argue very strongly that if you want to be involved in, for instance, increasing technology transfer to us, then you, namely the developed world, must be willing to trade with us for our goods. Trade barriers are unhelpful as far as, if you like, the totality of the relationship is concerned.

Ian Smyth: John, I just had to double-check your business card to be sure that you were still with Environment Canada. Your Minister, the Honourable Jean Charest, before a small crowd of about 500 people in Calgary a couple of weeks ago, said that the potentially largest single body of non-tariff barriers present or looming in our future would in fact be the environmental barriers which might be erected against our exports.

He referred, for example, to the movement in Europe at this time which is attacking the forest products industry in this country. He offered the suggestion that this kind of non-tariff barrier would become quite commonplace, or could be, and it would be in our collective self-interest, if nothing else, for us to be aware of that and to take appropriate steps not to get caught in the non-tariff barrier environmental trap.

John Hollins: Yes, I alluded to this very same point in my talk this morning. See the foot of page 41.

Question: My name is Phil Larstone. I am from Prince George, and represent the B.C. Energy Coalition. I have a number of questions and some of them refer to specific statements that have been made that I have trouble accepting because I think they are stated in an incomplete frame of reference and are contributing to misinformation.

I will go to the most general and most important of my points. As Dr. Hollins pointed out, we need to look at ourselves, not as merely here to divide up the energy markets of the world, but to consider ourselves as human beings in the context of our ecological system. And I don't want to be taken as a doomsayer or as putting a kibosh on everybody's energy plans, but I'd just like to paint a scenario for everybody's consideration.

While the information that has been presented is based on thorough analyses of economic and technical data, the positions are based on models which have an enormous component missing. And that, of course, is the most recent data on the most overriding of all environmental issues. Just last week a National Aeronautics and Space Administration (NASA) report was released stating that we can expect up to a 40 per cent thinning of the ozone layer over our country. And we can expect this several times a decade depending on the high-altitude temperatures, our winter temperatures. The cooler the temperatures the more the thinning.

In the years where this occurs the loss of ocean phytoplankton, the total failure of our cereal crops and the severe impacts on our forests and soils not to mention our wildlife will liberate vast additional quantities of greenhouse gases into the atmosphere.

So there's a link between the ozone levels and the CO_2 concentrations. And this will greatly accelerate greenhouse gas creation and contribute to climate changes. Additionally, positive feedback on greenhouse effects from the acceleration of methane and CO_2 released from Canada's vast wetland areas, as our temperature increases, will cause global warming to become a runaway condition, to borrow Dr. Scott's terminology.

The inhospitable living conditions that will occur will then result in an end to the era of population growth and cause a rapidly declining demand for energy services. This will change our positions with respect to market share of energy. My question is, "Are any of you prepared to reevaluate your industry or your viewpoint in the energy market shares and energy services in light of the new ozone depletion information?"

Bill Gatenby: Yes, if you go back to the problem that I had with the warm temperatures in Saskatchewan, then it appears that something seems to be changing. We

are not sure, though, as the scientific data is awfully hard to assess. But if we go to the young lady's question a moment ago, if you're worried about greenhouse gases, part of the solution, we think, is nuclear reactors because, as Mr. Hatcher has said, they don't put anything into the air, so they are ideal from the air quality standpoint..

But nothing is for free. Nothing is easy. Everything has its side problems and nuclear waste disposal is a problem which we think is under control, which we think scientifically can be done very well, but it's not easy to convince the public, nor should it be.

But you have a good point; ozone depletion is a worry.

Giacomo Capobianco: Well, we all are entitled to interpret science any way we want to, I guess. A report I'd like to draw your attention to is one from a respected 'Think Tank,' the George C. Marshall Institute in the United States, that I read last week.

It surprised me. It was prepared by respected scientists. They have looked at all of the satellite data that's available in the United States. Their forecast is that sea levels will drop, not rise; their forecast is that the maximum amount of warming that the Earth will see in the next hundred years is less than one degree which is less than the national variance. So it depends on what you read, I guess.

David Scott: Just a quick comment. I think that a couple of things that were said here are true. First of all, we always operate with incomplete information. Those of us that have given talks here today recognize that they are necessarily very incomplete. Yes, there's a lot of lack of information still on how the world is really working. But I think that there is hope for the future. This is not doomsday.

I go back to the simple idea that I was leaving with you. People want the energy services. I don't think that they want energy. We can talk about that. Energy consumption which seems to be leading to environmental problems will diminish in time as will the amount of energy that we use. As you see, there is a way out in these things. The ozone losses are coupled to CFCs, perhaps to CO_2 as well. So you can't decouple those things, they are linked together.

It's a matter of how fast we want to move to implement them, but technically we can eliminate CFCs. In fact, our lab is working on a very advanced technique for liquefying natural gas that uses refrigerants that totally avoid CFCs.

But fundamentally it is this: If you go back to the CO_2 and global warming, I think I am with the people that say we just don't know yet. But I am very concerned that we may be facing a major problem. Yet there still is an answer, and the answer is we can evolve towards non-fossil energy sources if we have to. That is possible.

The second thing is that you can then evolve towards energy currencies which do not use carbon. And that means you can – and we've got one of them, it's called electricity – you can go to another one; it's called hydrogen. As a throw-away comment, the main reason that we use carbon in liquid fuels today is as the liquefying agent; its energy content is less important. The trick with these low-carbon fuels, whether it's natural gas or hydrogen, is to just get better means of onboard storage. We're moving in that direction too.

So there are answers there, and I think that the question relates to the rate of technological change, and the rate will be determined by overall societal constraints. I agree that maybe we can lead, but we can't lead too much. We can't price ourselves out of world markets by enclosing externalities.

Voice in the Audience: Don't forget geothermal.

David Scott: Geothermal? Well, I can't resist commenting on that. You know, the trouble is that if you are far from something or haven't used it, you always think that it's neat. If you go to Hawaii there are a lot of constraints on geothermal now. One is mythological. Pele is the Polynesian goddess of volcanos and some of the local people are very troubled that we are drilling holes 'into' Pele, so people now go around carrying protest signs against geothermal drilling.

Note that the effluents from geothermal wells are often very noxious. I am not saying it won't work. I am saying a lot of these things, as most speakers have said, will work, but please recognize that none of our energy sources come without some sort of negative externality, if I can put it that way.

Ian Smyth: I am not going to let this discussion get away without one of my own rants since I'm hearing one or two from other corners.

I am deeply troubled by the fundamental norm which seems to dominate Canadians in their perception of environmental issues. It's really simple, everybody wants to go to heaven and nobody wants to die to get there. What I see is a country in which the dialogue runs like this: "How much would you pay per month in taxes to ensure environmental quality?" "Oh, ten bucks." "Would you pay $20?" "Well, maybe." "How about $50 or $100?" "Oh, no way!"

What Canadians do not seem to have internalized yet is that their comfort, their convenience and their pocketbooks are all going to be significantly affected if they want the environmental quality that they are demanding. I am moved by the experiences that I have had

periodically in Toronto on Highway 401 or on the Queen Elizabeth Way coming from the airport, where every now and again I stop and systematically count the first hundred cars that pass by. Every time I've done this over six years, not less than 70 of those 100 cars only has one person in it.

When you talk about beginning with simple solutions like efficiency and conservation and we can't even get moving in those directions, I have a real problem. 85 per cent of Canadians believe that they are environmentally concerned, they care. 84 per cent of them state that they think that they care more and do a better job of managing the environment than their neighbours. Think about that for a moment as an exercise in hypocrisy.

What's really interesting is this dialogue: "Well, what do you mean, green?" "Well, I buy green products." "Well, what do you buy?" "Well, I buy green diapers, I buy green detergent, dishwasher." "Oh, really" "How about green houses, green cars, how about a green refrigerator?" "Oh, no, no, no, I couldn't afford that." So you know, we had better put our money where our mouth is. We need massive education programs.

It's all well and good for each of us to sit here and market our particular brand of snake oil but the fact is that the Canadian public as a whole wants to have it both ways and until and unless we can attack that root cause, and I am not addressing the good conservationists in this room who came into speak to us, I'm talking about the great mass of the Canadian people out there who don't seem to share these values very actively because they don't want to pay for them. They want to observe the practices. There are whole cities in this country without any recycling programs and even if they did, what would it matter, because there's no way to use the stuff that's been recycled or stored. So if we are going to address energy issues and energy policy as a generalization, we'd better start with education for a public which is truly prepared to put its money where its mouth is.

Judith Myers: Thank you, Ian. Both Ian and Giacomo suggested that one of the things that Canada could export is technology, energy technology. Now, somebody has asked: "How can we expect developing countries, who already have these massive foreign debts, to be able to pay for clean energy technology?

Ian Smyth: Well, if the answer is that if nobody wants to pay commercial rates for it, then the research and the development of new technologies will die, and that's the issue around this business of "Are we going to export at most favourable and most concessional rates?"

The answer to that, as far as I am concerned, and where I think the negotiations are headed is that intellectual property rights will be respected. That means it will be government-to-government deals, so the Government of Canada might come to Company X and say, "We really like your technology, we think it's got good environmental benefits and we want to see it exported to a developing country. We will pay you the commercial rates for that technology. We will pay the difference between the commercial rates and what that developing country can afford." I think that's where we are headed.

You can react in various ways. One is: "Do we want that much government interface out there?" But I believe it's important that commercial aspects of technology transfer be respected, or it's just won't be developed.

Bill Gatenby: For the purpose of speculation, I would simply add that I can foresee a future with a world market in emission permit trading, where we could be buying permits by trading technology to developing countries for some of their emission 'credits.'

That opens up a whole new area which I don't think we want to get into here, but I do believe in the marketplace and when we talk about full-cost accounting in a world economy, looking at environmental issues on a global basis, the possibility of a global permit trading system is not by any means outrageous or far-fetched.

Question: I am Kent Goodwin from Kimberley, representing the B. C. Energy Coalition. I have a question for Dr. Davis but I have to respond to Mr. Smyth first.

We do need a lot of education and you are right about that, but basically, what we are faced with is a very poorly designed economic system. It is forcing people to make very bad choices about driving their cars and buying diapers. In order to help people make those good choices we have to internalize all the costs and then it will be much easier. More than anything, I think you're making a comment on the poor design and performance of our economic system

Now, we could debate back and forth about relative market shares between the petroleum, gas, coal and nuclear industries, but in the end we are all going to run up against the issue of population growth. And here's my question to Dr. Davis: "Is there a role for the World Energy Council to play in trying to do something about population growth in a very tangible way by having its member groups or the Council as a whole put some resources into dealing with that problem?"

Derek Davis: I can only answer in a sense from a personal point of view and from the point of the view of the Commission and the view we have taken on this subject. I think the answer is 'No.'

There is no way in which we can presume to advise anybody on population growth, of course. I think all we can do is in a secondary way, by drawing attention to the implications of population growth as far as the energy business is concerned. We have to stick, I believe, to our lasts as energy experts, but in parallel with that,

as citizens of the world, point out what the implications of population growth are to the prospects of providing energy to individuals in the poorer countries.

We can draw all sorts of interesting curves and graphs which relate the mortality rate to the energy used per capita, etc., just to reinforce how important energy is in the context of population growth. We can recognize that population growth is lower in countries where there is adequate energy and reasonable economic growth.

A whacking great chart arrived in my office a few months ago showing the per capita sale of condoms across the whole world. And it's remarkable. I mean, when all the furore about the subject of the chart had died down, as to how interesting it was. It's remarkable how close the correlation is between economic status and population control.

I think that we can only deal with exploding population growth in a secondary way, recognizing what the problem is, drawing it to the attention of those much better qualified than we are in the social context to control and advocate ways of controlling population.

Kent Goodwin: Well, I think that if you do that and if you continue to point out that you will not be able to provide the energy services forever if population isn't controlled, that would certainly be a major step forward.

Judith Myers: We're running out of time, so I am going to have to cut off further questions. I think some of the speakers may be around for a bit after this session and you will be able to get in touch with them if you have specific questions. I certainly have a lot more questions up here that we did not have time to deal with.

I would like to use my final minutes to thank the panel, both from the earlier session and from the most recent session, for their presentations and for their contributions to the discussion.

I think that it's very positive to have the sort of debate that has gone on here today where there are very divergent points of view. I think that the global scene is becoming an important aspect in the future considerations about how Canadians are going to deal with their economy and their use of energy resources. And I think that the best way to summarize this morning's session is to recall Ian Smyth's statement that what everybody wanted to do was to get to heaven without having to die. There are some of us who feel that by coming to British Columbia we have already accomplished that!

Martha Walden: I would like to publicly thank B.C. Hydro for their very generous support in bringing a number of environmentalists from distant parts of the province to this Forum so that you can hear some of our opinions. I think it's a very good sign for the future that we're able to get together here. Thank you.

Judith Myers: Dr. John Foster, this morning's plenary session Chairman, has a few words for us.

John Foster: Well, thank you very much, Judith. I think you'll all agree that we've had a wonderful session this morning. There have been some great presentations, some very good participation from the floor, so once more, thank you all very much.

Question Answered by Derek Davis after the Forum:

Question: Please give us your estimate of the proportions of the nuclear generation in the year 2020 amongst fission, breeder reactors and fusion.

Derek Davis: This is my personal view. As for fission, I expect a thermal nuclear component of about 800 million tonnes oil equivalent out a world total of 13,600 mtoe in 2020; i.e., roughly 6 percent of the total.

Fast breeder reactors will probably deliver zero or something negligible by 2020. I expect some identifiable production by 2030-2040. At least, I hope so.

Fusion will deliver nothing – not until well past 2050, in my view.

Questions Answered by Dr. David Scott after the Forum:

Question: How important is it to break the link between energy sales and utility profits, in order to make the conceptual leap from treating energy as a commodity at a price to treating it as a service to be provided to society at least cost?

David Scott: I don't fully understand your question. But I think the link between sales and profits (or lack of them), which really is a matter of public priority when these are publicly owned utilities and is simply a matter of whether the public wants to use taxpayer dollars to subsidize the utility, to have the utility 'break-even' or have the utility be a source of public revenue. For shareholder-owned utilities, like our gas utilities, it is not a question. These utilities must make a profit.

If we, the public, want to push utilities in one direction or another, we should keep in mind that the provision of energy by the gas, electric, or other utilities in Canada, is accomplished at comparatively low prices with respect to any other region of the world.

The point of my talk was that *neither* electricity nor gas is an energy service, they are energy *currencies*. The services are communication, transportation, health care or whatever. Typically, utilities operate in the 'source to currency' domain of the energy system. They tend to optimize that part of the system. Indeed, it is remarkable that electricity utilities, like B.C. Hydro, are going beyond their domain to encourage efficiency downstream (their business stops at the delivery of electricity). It is a

remarkable cultural phenomenon that B.C. Hydro sends its employees to tell folks like you and I how to make our houses more efficient, and even give us rebates for throwing out inefficient refrigerators and installing more efficient ones. B.C. Hydro would have a harder time serving the system this way if they did not have a substantial revenue stream coming from electricity sales.

Question: Would you agree that heat is a valid currency? If so, why isn't it on your list of currencies?

David Scott: Yes, heat is a valid currency. In fact, it could easily have been included on my slide, for it provides services both in many process industries and, of course, in space heating. In all cases, I had illustrated currencies, as well as other links in the chain, by *examples*. These examples illustrate the idea, and were not intended to be inclusive. Heat might be a good one to include in the future.

Question: Is it possible to convert hydrogen directly into electricity? If so, what is the process?

David Scott: Yes, converting hydrogen to electricity is done directly through fuel cells. Fuel cells have been the staple onboard electricity-generation technology for space flight ever since space missions began. Several companies have attempted to build and market fuel cells for terrestrial transportation systems One is Ballard Technology Corporation of North Vancouver.

Question: Why did you not mention ethanol made from biomass? What happened to Brazil's use of ethanol for automobiles? I understand that Professor Laszlo Paszner of UBC has found a method of producing ethanol at a much lower cost.

David Scott: There are many things that I did not mention; ethanol was only one of them. My own feeling, however, is that ethanol will not be a big player in world energy systems. From what I know, the use of ethanol in Brazil was an economic failure, although it is a failure not much talked about. The alcohol, ethanol, is nearly always produced by fermentation processes. Fermentation is extremely energy inefficient. The only significant use in North America, that I am aware of, was politically driven, when the US government wanted to give the farmers something to do with their grain after they had decided to respond to the east/west glitch-of-the-day by cutting off grain shipments to Russia. No one ever said it made either energy or economic sense. And the studies that showed that it didn't make sense were suppressed for obvious political reasons.

I am unaware of Professor Paszner's method of producing ethanol. It may be much more economical; I hope that it is. But so far, from the evidence that I have seen in producing alcohol fuels, methanol produced by thermo-chemical processes seems to be a more likely alcohol for widespread use than ethanol produced by fermentation. Still, all alcohols have some difficulties that have so far been largely screened from the public.

Question: Why do you think methanol will have a large impact as a substitute for gasoline?

David Scott: I do not think methanol will have a large impact as a substitute for gasoline. Studies (both by our Institute and by others at the University of California, Davis) have shown that the air-quality benefits and carbon dioxide emission reductions achievable by using methanol in place of gasoline are marginal at best.

Questions Answered by Dr. John Hollins after the Forum:

Question: Emission gas projections seem to assume that personal transportation will continue to use the technology we have today. Why? Motor vehicles are just inefficient and dangerous motorized versions of horse and carriages. Can't we do much better?

John Hollins: Traditional econometric projections do not take account of technological factors, they just assume that technologies will be there when the economics call for them. Projections are not what we do with MARKAL. In a sense, we are doing the opposite; we are backcasting. We examine all the available and emerging technologies and identify the best mix of technologies to balance the energy budget, meet environmental requirements, at the minimum overall financial cost. Our modelling progressively introduces more efficient vehicles, and in some scenarios, opts massively for new technologies using natural gas.

Question: In your Ontario scenario for constrained acid rain and 20% CO_2, how much of the existing energy levels was assumed for supply-side efficiency potential? And for demand-side efficiency potential?

John Hollins: No assumptions were made for efficiency, the model calculated the best mix of technologies to meet the economic scenarios that were assumed and the environmental requirements that were tested. The introduction of efficiency measures amounted to some 23% of the demand that would otherwise have existed in both the economic cases we examined for stabilization or reductions of CO_2.

Question: In your most aggressive model of CO_2 reduction in 2020, what role did conservation, i.e., negawatts, play in renewable resources? Pie charts shown by other speakers imply a minimal impact from developing all economic conservation potential. Comments?

John Hollins: Negawatts accounted for 23% and 33% of overall demand in Ontario and Quebec.

Question: You stated that Ontario requires additional nuclear resources to attain a 20% CO_2 reduction. Why not factor in the existing hydroelectric surpluses in

Quebec and Manitoba to displace nuclear with this more environmentally-friendly resource?

John Hollins: In our research to date, we found that for a high rate of economic growth, it was technologically impossible to make a 20% reduction in CO_2 in Ontario without using nuclear energy. But our studies have only examined Ontario and Quebec on their own. There is substantial potential to trade more electricity between these provinces; our next round of modelling will examine the effects of using stronger links than those that exist today. We haven't had the resources to build a MARKAL database for Manitoba, or other provinces, but we look forward to expanding our modelling, we hope, with some partners!

Questions Answered by Murray Fraser after the Forum:

Question: What would you deem to be acceptable reasons for offering mitigation in lieu of avoidance of resource development?

Murray Fraser: Where the benefits of resource development exceed the costs of mitigation, I would expect mitigation to be offered.

Question: At what time in the future can you see the elimination of trees for wooden pole distribution lines and the adoption of total underground service?

Murray Fraser: I do not expect to see total underground service in the foreseeable future due to the prohibitive cost in areas of bedrock, water crossings and other obstacles. The use of wood poles as opposed to alternative such as concrete poles, steel poles, etc., is a matter of economics; their costs vary widely in different parts of the world.

Question: Does the cost of electricity in Manitoba reflect the **full** cost of producing and delivering that commodity? If not, do you think it would be a good idea to increase the unit cost of power to Manitoba's residential and commercial customers to recover full costs, including environmental externalities?

Murray Fraser: The cost of electricity reflects all the costs allowed by the Public Utilities Board in Manitoba. I am not aware of any intervenor before the Public Utilities Board identifying any cost that should be included but has been omitted.

Questions Answered by Ian Smyth after the Forum:

Question: If we adopted a carbon tax on our emissions and sent the money so raised to the developing world to buy pollution abatement equipment for their inefficient power plants, what guarantee would we have that the money would actually get there and not disappear into the pockets of the local politicians?

Ian Smyth: It's true that aid money sent to third-world countries often seems to get whittled down in the pipeline. But I would hope that monies earmarked for pollution abatement in the developing world would be designated for specific projects that directly benefit the local people. But I agree that it could be a problem.

Question: Assuming that you are a firm believer in the role of the market and prices, how do you think we should incorporate external costs such as impacts of local air pollution and greenhouse gas from thermal power plant emissions into the price consumers pay?

Ian Smyth: There is no agreed-upon method of assessing the impacts of greenhouse emissions from thermal plants. Any 'Carbon tax' that might be imposed by the regulatory authorities would have to be based on an arbitrary formula. The next question is who would receive the transfer payments raised by such taxes? Local effects from SO_x and NO_x affect people downwind of the stack but greenhouse gas emissions affect everyone in the world. How do we compensate everybody? That issue is even more troublesome.

Question: You are to be congratulated for your awareness of the need to reduce atmospheric pollution in the Third World. You may also be right in your assertion that there are diminishing economic returns for adopting ever more stringent pollution controls on Canadian industry. But have you considered the negative perceptions in the Third World if we are **not** seen to be reducing our disproportionate share of per capita emissions?

Ian Smyth: I don't think the Third World is overly concerned about the greenhouse gas issue. They are worried about drinking water, famine, poverty and a host of urgent problems. I think their priorities lie more in raising their standards of living. I think their view is that if there is a global warming problem, it's up to us to solve it, not them.

Question: You stated that burning natural gas results in the lowest CO_2 production per unit of energy. It is reported that somewhere between 3 and 20 percent of the gas gathered at the wellhead consists of CO_2.

Do you include this CO_2, which is presumably all released to the atmosphere, in your assessment of the merits of natural gas as a fuel?

Ian Smyth: Yes.

Question Answered by Giacomo Capobianco after the Forum:

Question: Past environmental standards were nothing like today's. How should the environmental impacts of past developments be remedied? I'm thinking of abandoned strip mines for brown coal, peat and lignite around the world that were never cleaned up.

Ciacomo Capobianco: Not only were standards not as strict as today, but our awareness of our effects on the environment was poorly developed. As a result there are many examples worldwide of 'orphaned' industrial sites, many of which pre-date modern legislation or whose owners are no longer in business.

The worst sites appear to be in the former Communist bloc. By contrast, coal mine sites in Western Europe, while not perfect by today's standards, have been reclaimed to varying degrees.

The problem, of course, is how to prioritize limited resources, and money is a key factor. If the sites are truly 'orphaned,' there is little choice except for society to decide to finance reclamation. The logic is that the society benefited from the employment and taxes the operation supported, and frankly, there is little choice.

The same logic must be applied to operating sites, where companies met the then-current environmental standards, but are now found wanting.

Where economically possible, companies might play the lead role in correcting past mistakes, but care must be taken not throw the baby out with the bath water. Too rigid a posture on the issue by society could severely damage key industrial sectors.

In summary, abandoned sites are a societal problem. A balanced, consultative approach to solving it is called for. Both industry and Government will be required to play appropriate roles.

Happily, the Canadian coal industry has been very far-sighted in this regard. As a result, there is no backlog of unreclaimed sites in this country.

Question Answered by Bill Gatenby after the Forum:

Question: Nuclear plants create no greenhouse gases like coal-fired plants do, but they produce long-lived radioactive wastes. Which is worse? And the risk of one major nuclear accident, like the one that almost happened at Three-Mile Island, and did happen at Chernobyl, would far outweigh the benefit of no greenhouse emissions in my mind. Comments?

Bill Gatenby: You've raised two issues. The first is to compare radioactive wastes to greenhouse gas impacts on climate. To my mind, the radioactive waste problem is by far the lesser of the two. Second, you worry about a nuclear accident worse than Chernobyl. We've had nuclear power plants in operation for nearly 40 years, and Chernobyl was the worst. It's hard to say whether the long-term effects upon the people around Kiev were worse than the possible effects of global climate changes on everyone in the world, which might result in an increase in average temperatures of a degree or so and increases in average sea level of a few centimetres. I would agree that Chernobyl-like accidents, with their sudden occurrence, are the more serious of the two.

Questions Directed to the Panel After the Forum:

Question: What are the costs of electric energy from new hydroelectric, nuclear, coal-fired, and gas turbine generating stations at the present?

Answer: The following data are taken from B.C. Hydro's publication 'Electricity Plan Update,' issued in March, 1991.

Source	Project Size MW	Energy Cost ¢/kW-hr
Coal-fired, conventional	2000	5
Coal-fired, waste coal	600	7
Coal-fired, adv. technology	1000	6
Wood-waste thermal	25	9
Cogeneration (wood/MSW)	25-45	6
Geothermal	55	7
Small hydro	<5	3-4
Conventional hydro	900	5-9
Photovoltaic Solar	100	23
Tidal	660	30
Wind	16	14-24

Luncheon Address
A Report From The B.C. Round Table on the Environment and Economy

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Introduction of the Luncheon Program
by John Sheehan

At this point, I would like to call upon Brian Gates of the Ministry of Environment. And of course, you know that the Ministry of the Environment is a co-sponsor of this Forum. I would ask Brian to introduce our luncheon speaker.

Introduction of Bob Jamieson by Brain Gates

Thank you, and good afternoon, ladies and gentlemen. It's my pleasure to introduce Mr. Bob Jamieson to you.

Bob Jamieson is a registered professional biologist and a consultant in wildlife and land use issues with BioQuest International Consulting Ltd. A wildlife biologist by training, he has worked as a game warden, running a national park in Ghana in West Africa. He was also a wildlife manager in Alberta and in British Columbia, and he has run outfitting operations in both the Kootenays and in northern British Columbia.

Mr. Jamieson is the Past President and founding member of the Wilderness Tourism Council of British Columbia. As well, he is a member of the B.C. Round Table on the Environment and the Economy where he chairs the subcommittee on Economic Incentives and State of the Environment reporting. In addition to his consulting services, he operates a 200-head cattle ranch in the East Kootenays. Ladies and gentlemen, welcome please Mr. Bob Jamieson.

Luncheon Address

A Report from the B.C. Round Table on the Environment and Economy

Bob Jamieson

Member of the B.C. Round Table

A Report from the B.C. Round Table on the Environment and Economy

There's one little item I would like to add to Brian's description, and it's that I am also the President and Chief Executive Officer of the Ta Ta Creek Power and Light Company, which produces the enormous amount of 2,000 watts that run our house and ranch on the edge of the Kootenay River, in the East Kootenay where I live.

I should mention that apart from being CEO, I'm also the maintenance man and everything else. The experience of building that small power plant has taught me a few things about electricity and about some of the problems that many of the people in this room face.

One thing I learned from that experience is something I call the magic of electricity. I think that when most people in our society flick on that light switch, they don't connect it to the immense technological system that's behind that light switch. They don't sense the weight of water on a turbine that makes that light come on. Its magical, really. And I never thought much about it either, until I actually got into the process of building that system. So that experience has given me, frankly, some respect for all of you.

I also developed respect for you, because even though my project was very small, just a couple of four-inch pipes, I had to file an environmental impact statement. The only difference is when you guys go to a meeting and meet with environmentalists, you go home afterwards. I have to sleep with the environmentalist!

What I'd like to talk to you about today is the provincial Round Table on the Environment and Economy. The Round Table is made up of 32 people from around the province, from every sector of our society here in B.C. We have people like Paul Hanson, the CEO of Highland Copper, and Bob Kadlec from BC Gas; we have environmentalists Roselyn Mitchell, Rene D'Aquila from the recycling group here in the Lower Mainland; we have Native people, ranchers like myself, academics and people from every walk of life.

We were charged by the Cabinet Committee on Sustainable Development to act as an independent advisory board on the issue of sustainability in British Columbia, and how to bring the economic environmental and social issues that face us all together. It is, in effect, kind of a citizens' 'think-tank' on sustainability.

It's been a very, very powerful experience for me, and I think for everybody else who has worked on the Round Table. It's a unique experience. We've all had to work and deal with people from every walk of life, with totally divergent points of view; and totally different opinions on just about everything you can name. As one of my fellow members said the other day, it's not so much what's happened at the table as what has happened under the table that's been interesting. And by that I don't mean hanky-panky, but the fact that there's been an incredible exchange going on, and an incredible change in the viewpoints of people at that Round Table. We've had to learn to see other points of view, to come to understand and deal with other points of view and issues in a cooperative manner and to reach a consensus.

Those of you from outside of B.C. may not be aware that we have a land use issue in this province that involves resource developments. It is very divisive, and the two sides that are as likely as not to fly at each other are the environmental groups and the forestry sector.

It's been interesting for me to watch those two sides, as representatives of the Round Table discussion, and have two people arguing that are really miles apart, maybe a forester and an environmentalist; and then somebody from the energy sector, or a fisherman, jumps into the conversation and helps to bring about either an understanding between those people, or takes the argument off in a totally different direction.

That's the value of this kind of group. The group has coalesced. It has become operative, and, I think, very positive and very productive. One of the fellows in the office worked out the other day that we've sent out over 300,000 documents in the last two years. It's really brought a small group of 31 people together, as opposed to the 3.1 million people that are in this province, and working in a common direction.

Okay, what we has the Round Table done? We've produced a document called *Towards a Strategy for Sustainability*. There will be some copies available on a

table outside, if anyone would like one. What this document does is to identify the principles on which we feel sustainable society has to be based. We put a lot of time and energy into developing those principles. It then covers what we call a 'Vision for British Colombia in the Future,' where we try to see where we want to go; and then we looked at the actual state of the province today in terms of sustainability.

It was interesting that when we began writing this document, it started out as a 'report-card' on the state of the environment today, and then we realized that it couldn't be just that. In addition to it being a report on the environment, it also had to be a report on the state of social circumstances and on the state of the economy, because they are so intertwined that one without the other two simply doesn't mean anything. We then looked at how we are going to apply these principles to the conditions in B.C., and look at the kinds of changes that everyday life in B.C. is going to have to go through.

Interwoven with those kinds of large societal changes, of course, is energy, which is the life blood, the economic life blood of our province. We've also recently completed a paper entitled *A Sustainable Strategy for Energy*. It is the first of a series of reports on specific issues that the Round Table is looking at. Other reports we'll do in the future will cover local Round Tables, sustainable communities and others, but this report on energy is important, partly because it was the first resource-specific thing we looked at, but also because it's a crucial issue to all of us.

We developed this paper through stakeholder groups, workshops, and public consensus processes. In a sense, we tried to draw people from the energy community and from the public at large into the same process of seeing other's points of views that all of us on the Round Table have gone through.

It would be long and difficult to explain a lot of things that go on, but there's very subtle things we discovered that can make a real difference. We held an Energy Forum very early on in Cranbrook, my home town, near Ta Ta Creek; and instead of having the usual panel in front of audience, we arranged the chairs in the room into a big round table, and everybody was sitting around the table looking at everyone else. No one was elevated, as I am here. It was interesting to see the degree to which that changed the debate.

I think it's those kind of subtle changes that are going to take us forward in this province. The document deals with all kinds of issues you people are familiar with: from the risk of global warming, to efficiency, to pricing energy exports - all those kinds of things. At one of the workshops tomorrow morning, we will be addressing this document, and we very much would like to have you people here at this Energy Forum participate in that because we want to get your input into this thing before it goes to the Ministers. In the next month or so, the final recommendations are scheduled to go to the Cabinet Committee on Sustainable Development.

We learned some lessons in doing this report that I think are worth sharing. These are lessons from the Round Table and from the energy process and I think one of them is that the kind of stakeholder involvement that we are talking about here is operational; it works. When I first started out, when I attended that initial meeting and I saw 31 people at the table, I thought, "Oh, my God, how is this group ever going to get anything done?" The fact of the matter is that it works. With the kinds of issues and problems that we face today, you've got to have at least that many people at the table; you need all those viewpoints. Otherwise, you haven't got all the 'bases covered,' as it were.

The other part of it is that people really welcome the opportunity to get involved in these issues because they effect every one of us. And it's surprising, I think, the kind of rational, imaginative and positive response you get from people when you allow them that opportunity. If you can take the overall community and bring it forward through that kind of consensus-building process, it makes it a lot easier to reach agreement because you've got a significant part of society working with you on the issue.

The other thing that is really important to learn, I think, from these kinds of processes is called 'AAC.' Now, most people in this province think AAC means 'annual allowable cut.' I think it's more important if that acronym was considered to stand for 'attitude adjustment and change.' We've all got to change our viewpoints. Mine has changed significantly in this process, and I think it's a crucial part of what we do.

To finish, I just want to tell you a small story. I was going to call it an anecdote in my speech, but I was afraid I might say it was an antidote to my speech.

What I want to tell you about is an experience I went through when the Round Table first started up. We were looking for volunteers for the various subcommittees that worked in the Round Table. The energy subcommittee came up and Mike Halloran, another member of the Round Table, looked at me and I looked him and we both kind of rolled our eyes. We were both on a bunch of other committees, but we both felt we could not afford to not be on the subcommittee on energy. He and I were major opponents to many of the people from B.C. Hydro who are in this room, during the era of dam-building in the Kootenay region where I live. For those of you from out of our province, out of country, the Kootenays are located in the south-eastern portion of this province, and produce a significant proportion of this province's hydro power. And we didn't like hydroelectric projects very much in those days.

So we both volunteered for this subcommittee, and sometime later went to our first meeting with B.C. Hydro. In the old days, B.C. Hydro was Darth Vader incarnate to us. So I walked into this meeting feeling like Luke Skywalker and I got up there and I turned on my light sword. Bzzzz. Remember that one? And Darth Vader came up and he turned on his light sword. Bzzzz. And I was getting ready for a fight and he turned and said to me, "Have you seen my new light sword? It uses 30 per cent fewer watts. It's PowerSmart!"

There's been some attitude adjustment and change on all sides. It's absolutely crucial to understand that that's what we are all about in the 90s. And I think we have to look at changing these attitudes if we are going to resolve the very difficult problems that face us all.

Thank you very much.

John Sheehan: I would now like to ask Darlene Barnett, B.C. Hydro's Vice-President Legal and Corporate Secretary, to thank the speaker. Darlene Barnett.

Thanks by Darlene Barnett: Thank you, John. I suppose I was one of the people involved in the old days when Hydro was the Darth Vader who was trying to licence those hydro projects. The analogy was never used then, though considering my height, I would have appreciated being viewed in such a tall role.

It's a lot more fun now. The orientation then, if not confrontational, at least consisted of two points of view that seldom met. We never had a Forum like this where we could discuss things informally and try and come to a consensus. I think we are doing that more and more now.

Few of us enjoy the domestic intimacy Mr. Jamieson enjoys in his role of utility executive when he meets his environmentalist, but we hope that Forums such as this bring us to an appropriate proximity and that in the discussions, particularly today and tomorrow, when people get to participate we will at least reach understanding, if not domestic bliss.

We thank Bob Jamieson for his speech, for his analogy and for the work he's done on the Round Table. You'll notice that the topics shown on the program for this afternoon have a slightly different orientation, but they cover many of the same topics that were covered in the Round Table paper. We sincerely hope that everybody who can will participate in these sessions; giving feedback to the Round Table and to Hydro. Bob, it's a lot nicer to be working with you rather than against you.

Thank you for your remarks.

John Sheehan: Here are some housekeeping notes in connection with the program for this afternoon. As you know, the program now divides into two sessions.

The Energy Council stream itself will convene in the theatre downstairs for two most interesting panel discussions.

The B.C. Hydro stream will convene in three discussion groups, and those of you registered for these groups should already have tickets identifying the room in which you are to meet.

As far as this evening is concerned, unfortunately our scheduled speaker, the Honourable Jake Epp, will not be with us. He has gone to the scene of the mining accident in Nova Scotia and I'm sure all of us would excuse him for having to put that emergency ahead of our conference. The outlook for those trapped miners is not good, as was already mentioned this morning. However, his place will be taken by Mr. John MacDougall, Parliamentary Secretary for the Honourable Jake Epp.

Following the workshops and the two panels, at around five o'clock, two Memoranda of Understanding to be signed by the representative of the Energy Minister and Resources on behalf of Canada, and by B.C. Hydro and Centra Gas, representing our provincial utilities. These memoranda deal with improving the energy efficiency of Federal buildings and facilities here in B.C. That will take place in the foyer below us just outside of the theatre. We invite as many of you who are able to attend to be present at that significant signing.

With that, I will adjourn this luncheon. I encourage you to take part in the panel discussions this afternoon.

Thank you very much.

Panel Discussion: Efficiency and Competitiveness

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Stan Hatcher is President and Chief Officer of Atomic Energy of Canada Limited (AECL). He was formerly Head of the Chemical Technology Branch and Director of the Applied Science Division of Whiteshell Laboratories. He also served as AECL's liaison officer at the United Kingdom Energy Authority. Dr. Hatcher is Vice-Chairman of the Pacific Nuclear Council and has served on committees for the Pacific Basin Nuclear Conferences of Vancouver, Seoul, Beijing and San Diego. As well, he is a director of the Canadian Nuclear association and Vice-Chairman of the Energy Council of Canada.

Panel Discussion

Efficiency and Competitiveness

Panellists
Morgan MacRae
W. Peter Torbet
Jack Habart

Introduction of Panellists by Stan Hatcher

Good afternoon, Ladies and Gentlemen, it's my privilege to be your moderator for the two panel discussions this afternoon, the first of which is the Energy Council of Canada's panel on 'Efficiency and Competitiveness'.

1. Energy Intensity, Energy Efficiency and Conservation Defined

Energy efficiency and competitiveness are, I think, concepts that are key to enhancing what Canada can and hopefully will be doing domestically and in the world in the future. We in the Energy Council feel that this is so important that we are trying to set up a specific study within our Planning Committee to examine these topics.

Before we get into this afternoon's sessions, I would like to offer to you definitions of at least three terms that we run into frequently in such discussions. These are my definitions. They are important distinctions. And if the panel members wish to disagree or modify those definitions, they're welcome to do so. The first term is energy intensity. To me, that's a measure of energy per unit output. Aluminium production, for example, is one of Canada's basic industries. By its very nature, it is an energy-intensive industry, consuming a large amount of energy per unit of output. The second term is energy efficiency. Efficiency implies using the least possible amount of energy to produce a pound of aluminium. The less energy we use, the more efficient is our aluminium production process. The third term is conservation. Conservation actually implies not using the energy, or, at the other extreme, not making any aluminium.

I think it's important that we think in terms of these three definitions when we're looking at the question of efficiency and competitiveness. On a global per capita basis, Canada is often accused of being the largest consumer of electrical energy. If most of that energy goes into the production of aluminium, for example, which is sold to Japan, then it's not only Canadians that are using that electric energy, it's the Japanese and the customers who buy their aluminium products. If the world needs aluminium, and we have the most efficient and most economic energy to produce it, there's no reason I can see why we shouldn't be in that type of business, even though it is energy-intensive.

It's worth tying this in to Michael Wilson's discussion of the prosperity initiative. When Michael Wilson was opening a discussion on competitiveness with the provincial Trade Ministers, he commented, "There's a good deal of enthusiasm about taking ownership of the competitiveness issue. It's an issue whose time has come." His prosperity initiative, I think, addresses competitiveness from this perspective. It zeroes in on the concept of partnering with all the stakeholders involved. It's committed to developing a strategic response to the global challenge of competitiveness. And we see some aspects of this taking place right here in this Forum; that's what our session this afternoon is all about.

2. Panel One: Energy, Efficiency and Competitiveness

In this first panel discussion this afternoon, we're going to explore the link between energy efficiency and competitiveness. It should be a keystone in developing a broadly-based energy sector strategic framework that can respond to the challenge of globalization in an area that reflects one of Canada's real competitive economic advantages. If we do it right, we can get 'ahead of the curve' in the development of Canada's industrial response to this challenge. And I'm sure our speakers this afternoon will, in fact, stimulate your thinking on this.

Our first speaker is Mr. Morgan MacRae, who is Director, Coal and Electricity, at the Canadian Energy Research Institute (CERI).As such, he directs the Institute's research program in coal and electricity economics and related environmental issues. Prior to joining CERI, Mr. MacRae was responsible at various times for economic, financial, market and impact analysis of electricity, coal and bitumen with the Alberta Energy Resources Conservation Board. With TransAlta Utilities, he developed models for long-term energy forecasting. He has also worked as an economist for Ontario Hydro and the Ontario Ministry of Transportation and Communications. Mr. MacRae has published several studies for CERI, the U.S. Electric Power Research Institute and the Alberta Department of Energy.

From his experience in a number of provincial utilities and his research that now spans the whole country, Morgan is going to talk to us on how we measure efficiency.

How Do We Measure Efficiency?

Thank you, Mr. Chairman. Good afternoon, Ladies and Gentlemen. I am honoured to be a panellist this afternoon at the B. C. Hydro and World Energy Council's 'Energy Forum 1992.'

1. Introduction

Briefly, I will highlight the conclusions of a study completed by CERI and published last December, entitled *International Comparisons Interpreting the Energy GDP Ratio* (Study No. 41). In some respects, I'll say more on how we should **not** measure energy efficiency, rather than how we should measure energy efficiency. I trust the points I make will be of interest to Canadians, as well as those from the international community represented here today.

I have provided the conference organizers with a more extensive copy of my presentation (this text). If you require additional information on this study, please contact me at the Canadian Energy Research Institute .

2. Interpreting Energy/GDP Ratios

2.1 The Objective

The Canadian government is involved in the development of global conventions and protocols on energy and the environment. Controversy has arisen over the use of broad comparative measures of energy utilization to assess different countries' relative energy efficiencies and contributions to environmental degradation. If international conventions on energy and the environment are to beinfluenced by cross-country comparisons of energy utilization, it is important that the comparative measures be interpreted correctly.

Table 1 shows the primary energy consumption of 24 countries for four typical years since 1960, and each country's numeric ranking, in terms of millions of tonnes of oil equivalent consumed. Canada, with a population of about 25 million, ranks near the top. **Table 2** shows the same information after imports and exports have been considered. Again, Canada ranks near the top of the 24 countries examined. **Figure 1** displays the same information when divided by Gross Domestic Product. Here, Canada clearly ranks first in energy used per dollar of production. **Figure 2** shows Canada's ranking for a specific industry. In 1987, the Canadian pulp and paper industry ranked as one of the most efficient producers amongst the ten countries examined.

In addressing the question of how do we measure energy efficiency, Canadian representatives are faced with a perception that, on an international ranking, Canada is often cited as a profligate and inefficient consumer of energy. For example, a high Energy/GDP ratio is taken to mean that energy is used inefficiently and that the country is contributing disproportionately to environmental degradation through wasteful use of energy. **However, the energy/GDP ratio is an imperfect measure of energy efficiency and the environmental impact of energy production and use.**

Table 1: Total Primary Energy Supply for all OECD Countries

	1960		1970		1980		1989	
	MTOE	Rank	MTOE	Rank	MTOE	Rank	MTOE	Rank
Australia	31.549	8	51.332	8	70.380	8	85.459	9
Austria	10.936	13	18.078	14	23.028	15	23.834	15
Belgium	23.238	9	40.267	10	46.206	11	47.329	13
Canada	73.014	6	132.073	6	192.056	5	219.571	4
Denmark	9.033	15	20.183	13	19.489	17	17.941	19
Finland	9.781	14	18.071	15	24.997	14	28.953	14
France	79.494	5	147.249	5	190.657	6	219.009	5
Germany	142.651	3	234.379	3	272.934	3	271.597	3
Greece	2.528	23	8.095	19	15.973	19	22.036	18
Iceland	0.417	24	0.656	24	0.941	24	1.332	24
Ireland	3.779	20	6.257	21	8.484	22	9.769	23
Italy	43.057	7	110.733	7	139.105	7	163.467	7
Japan	82.296	4	256.385	2	345.612	2	404.576	2
Luxembourg	3.310	21	4.146	23	3.642	23	3.414	23
Netherlands	22.477	10	49.876	9	65.525	10	85.114	10
New Zealand	4.123	19	7.025	20	8.901	21	12.864	21
Norway	6.971	17	13.871	17	18.835	18	22.753	17
Portugal	3.004	22	5.980	22	10.401	20	16.073	20
Spain	16.159	12	38.381	11	68.691	9	86.350	8
Sweden	20.535	11	37.956	12	40.775	13	48.081	12
Switzerland	7.599	16	16.453	16	20.953	16	23.507	16
Turkey	4.830	18	12.227	18	31.928	13	49.639	11
United Kingdom	161.420	2	207.739	4	201.203	4	211.259	6
United States	1013.946	1	1545.861	1	1800.935	1	1943.466	1

SOURCE: International Energy Agency, *Energy Balances of OECD Countries*, 1991 (Paris, France: OECD/IEA, 1991) in Michele McLachlan and Imad Itani, *International Comparisons: Interpreting the Energy/GDP Ratio*, CERI Study No. 41, (Calgary, Alberta: Canadian Energy Research Institute, December 1991).

Table 2: Total Final Energy Consumption for all OECD Countries

	1960		1970		1980		1989	
	MTOE	Rank	MTOE	Rank	MTOE	Rank	MTOE	Rank
Australia	23.228	8	35.361	9	47.526	10	57.473	9
Austria	9.468	13	15.172	16	19.764	14	30.283	15
Belgium	17.562	10	32.426	11	34.673	11	33.804	12
Canada	64.390	4	109.512	6	154.917	4	164.063	4
Denmark	7.034	16	10.231	13	15.148	18	13.431	19
Finland	9.284	14	16.116	14	19.345	15	22.690	14
France	64.351	6	122.584	5	144.770	5	143.004	6
Germany	104.230	3	175.731	3	186.752	3	190.878	3
Greece	2.050	23	6.620	19	11.946	19	14.827	18
Iceland	0.391	24	0.610	24	0.827	24	1.083	24
Ireland	2.705	21	4.851	22	6.602	22	7.444	22
Italy	35.392	7	87.237	7	106.251	7	118.182	7
Japan	59.153	6	199.874	2	348.984	2	386.507	2
Luxembourg	2.737	20	3.738	23	3.313	23	3.237	23
Netherlands	15.396	11	37.704	8	52.047	8	50.948	10
New Zealand	3.405	19	5.296	20	6.834	21	9.233	21
Norway	6.556	17	12.878	17	16.509	17	17.582	17
Portugal	2.685	22	5.060	21	8.481	20	12.173	20
Spain	13.742	12	33.075	12	50.660	9	58.752	8
Sweden	19.343	9	33.738	10	34.481	12	35.178	13
Switzerland	7.268	15	15.225	15	17.639	16	19.731	16
Turkey	4.001	18	9.497	18	27.119	13	39.108	11
United Kingdom	117.900	2	144.481	4	137.008	6	147.946	5
United States	827.565	1	1211.368	1	1318.746	1	1393.711	1

SOURCE: International Energy Agency, *Energy Balances of OECD Countries*, 1991 (Paris, France: OECD/IEA, 1991) in Michele McLachlan and Imad Itani, *International Comparisons: Interpreting the Energy/GDP Ratio*, CERI Study No. 41, (Calgary, Alberta: Canadian Energy Research Institute, December 1991).

Although CERI assessed other broad measures of energy, we focused on the Energy/GDP ratio due to its potential importance in upcoming international discussions. Our study was undertaken to assist Canada's delegates at multinational congresses and negotiations to move beyond the issue of relative energy utilization measures, and the stigma of being 'wasteful' consumers of energy, to the more important objective of assisting in the international search for cooperative solutions to our global environmental challenges.

2.2 The Approach Taken

The approach taken in CERI's study involved identifying differences in the relevant factors between countries and explaining qualitatively how these differences affect energy use and the relative energy/GDP ratios for different countries.

Since the energy/GDP ratio is commonly used for comparing energy utilization between countries, it is important that its suitability for addressing issues such as energy intensity, energy efficiency, or environmental emissions problems be discussed.

The main problem with the energy/GDP ratio is the level of aggregation at which it is calculated. The ratio hides many complexities that can only be addressed if comparisons of energy utilization are conducted at a disaggregated level. Both energy intensity and energy efficiency are best analyzed at a disaggregate level where output can be measured in physical rather than monetary terms and where it is possible to compare and contrast similar outputs.

Indeed, due to the different output mixes in different countries, energy efficiency can **only** be analyzed at a disaggregated level. It is fundamentally wrong to use the energy/GDP ratio as an indicator of energy efficiency. The ratio can be used as a (rough) measure of aggregate energy intensity, but it should be used cautiously given the problems associated with aggregating output in monetary terms.

Given the above discussion, it should be clear that the energy/GDP ratio is not a good measure of energy intensity, and does not measure energy efficiency at all.

3. Conclusions

Our study concluded that, firstly, the energy/GDP ratio is not the simple, straightforward measure that it appears; it is a very aggregate measure that hides many complexities.

The energy/GDP ratio is affected by many factors, such as climate, geography, population density, industrial structure, income levels, prices of energy and other inputs, and resource endowment. To date, most attempts to resolve the differences in energy/GDP ratios between countries have involved 'correcting' the ratio for differences in some of these factors. While such quantitative adjustments can be useful, they are necessarily *ad hoc* because there is no 'correct' method of adjusting for these differences. Hence, such adjustments would not provide 'correct' energy/GDP ratios.

The energy/GDP ratio is also not a good indicator of relative contributions of different countries to energy-

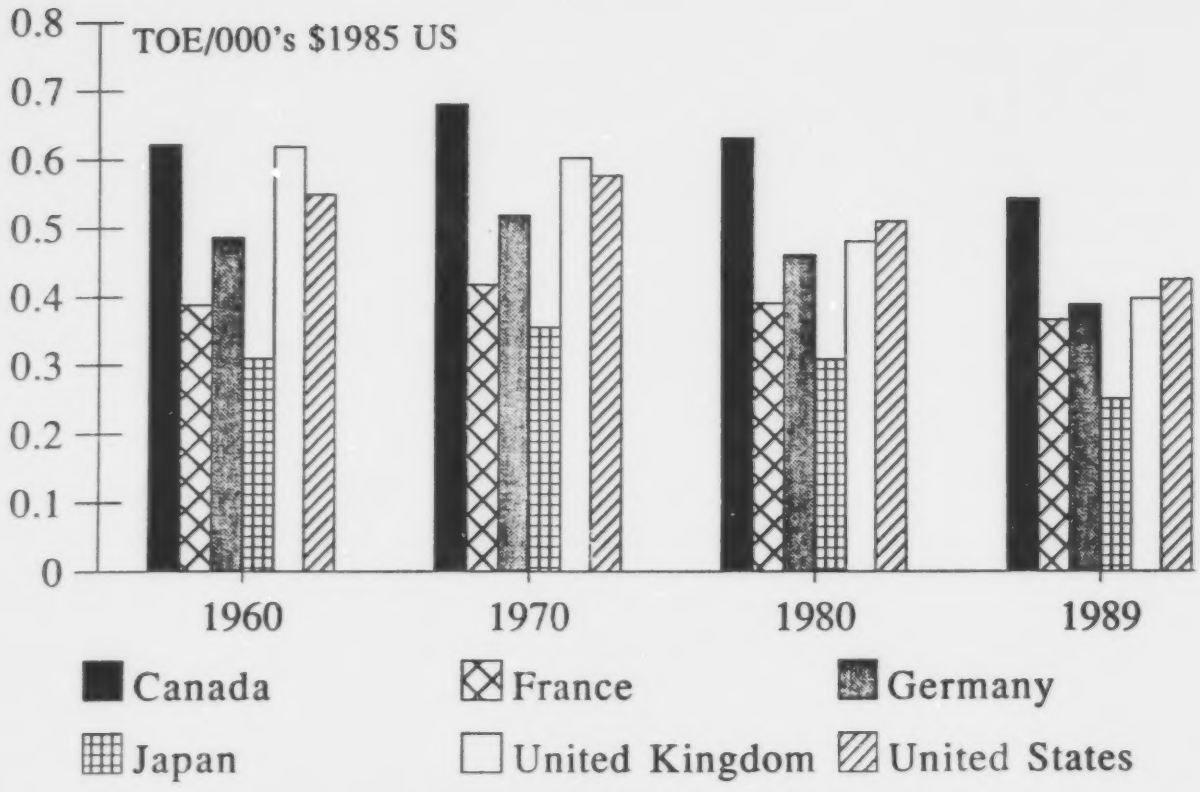


Figure 1: Energy/GDP Ratios for Six Countries

related environmental emissions problems. For example, two countries with similar energy/GDP ratios may be having very different impacts on the environment, depending on the types of energy used and the production and combustion technologies employed. Notwithstanding these critical limitations, the energy/GDP ratio is still being employed in international comparisons of energy utilization.

Differences in energy/GDP ratios between countries do not imply inefficient use of energy in some countries relative to others. Energy efficiency, which is concerned with minimizing the amount of energy used to produce a particular output, can only be assessed at a very disaggregate level. The energy/GDP ratio does **not** measure energy efficiency and should not be used as an indicator of relative energy efficiencies in different countries.

Our second conclusion was that there are legitimate reasons for differences in the ratio between countries; it is misleading to use the ratio as an indicator for purposes of comparing relative energy efficiencies and impacts on the environment.

Variation in energy/GDP ratios across countries is consistent with economically efficient decisions being made in each of the countries. The differences in the ratios occur because decision-makers in different countries face different circumstances and make different, but nonetheless economically-efficient, decisions.

Our qualitative assessment suggests that the differences in energy/GDP ratios existing across countries are as expected, after giving due consideration to differences in energy supply situations, economic conditions, relative factor availability and energy requirements. The importance of understanding the underlying factors and the implications of differences in the factors cannot be overemphasized. Given this, policy makers should be wary of using a measure such as the energy/GDP ratio to determine standards, targets, or penalties concerning energy use, without first ensuring that they have a good understanding of what lies behind the ratios and of the ramifications that inappropriate policies could have on the competitive positions of various industries and countries.

Energy utilization decisions should be made with economic efficiency as the goal rather than energy efficiency. That is, the goal should be to minimize total costs of production, not to minimize the cost of energy, which is only one input to the production process. While the production process that is chosen to achieve economic efficiency may not be energy-efficient, energy efficiency is being given due consideration.

Thirdly, we concluded that the energy/GDP ratio is an unsuitable measure for addressing issues of international energy efficiency or the energy-related environmental impacts of individual countries. Using it for purposes for which it is unsuitable will lead to the development of inappropriate policies that could have undesirable effects on the international allocation of resources.

If comparative measures of energy utilization are to be used to address problems related to the energy/environment linkage, it should be recognized that there are problems with using energy utilization data as a proxy for the magnitude of the environmental emissions resulting from energy use.

3.1 Is the Energy/GDP Ratio Good for Anything?

Given that energy/GDP ratios are expected to differ across countries, rather than focusing on the relative magnitudes of the ratios, an approach that examines changes in the ratio over time within individual countries may provide useful information about relative improvements in energy efficiency.

4. Addendum: Interpreting the Energy/GDP Ratio

The energy/GDP ratio measures the amount of energy used per dollar of output produced in a given country.

The amount of energy used in a particular country, the numerator in the energy/GDP ratio, is affected by numerous factors: climate, population density, industrial structure, income levels, relative input prices, energy endowments, etc. The differences in these factors should be identified and understood if the reasons for differences in energy/GDP ratios between countries are to be understood. Energy intensity refers to the amount of energy used to produce a unit of output. The energy/GDP ratio is a measure of energy intensity, but using it in comparisons of energy intensities in different countries leads to erroneous conclusions..

Since GDP is measured in monetary terms, international comparisons can only be conducted by converting the GDP measured in various national currencies to a common currency. Thus, the energy/GDP ratios are affected by the prices and exchange rates used in the calculation.

The energy/GDP ratio is a highly aggregated measure of energy utilization. It does not address the issue of energy efficiency and has significant limitations as a measure of energy intensity.

The energy/GDP ratio is not a measure of nor an indicator of energy efficiency. Energy efficiency analyses can only be undertaken at the process level; only at this level is information sufficiently detailed to permit valid comparisons of relative efficiencies.

The energy/GDP ratio can be used as a rough indicator of energy intensity because it determines the

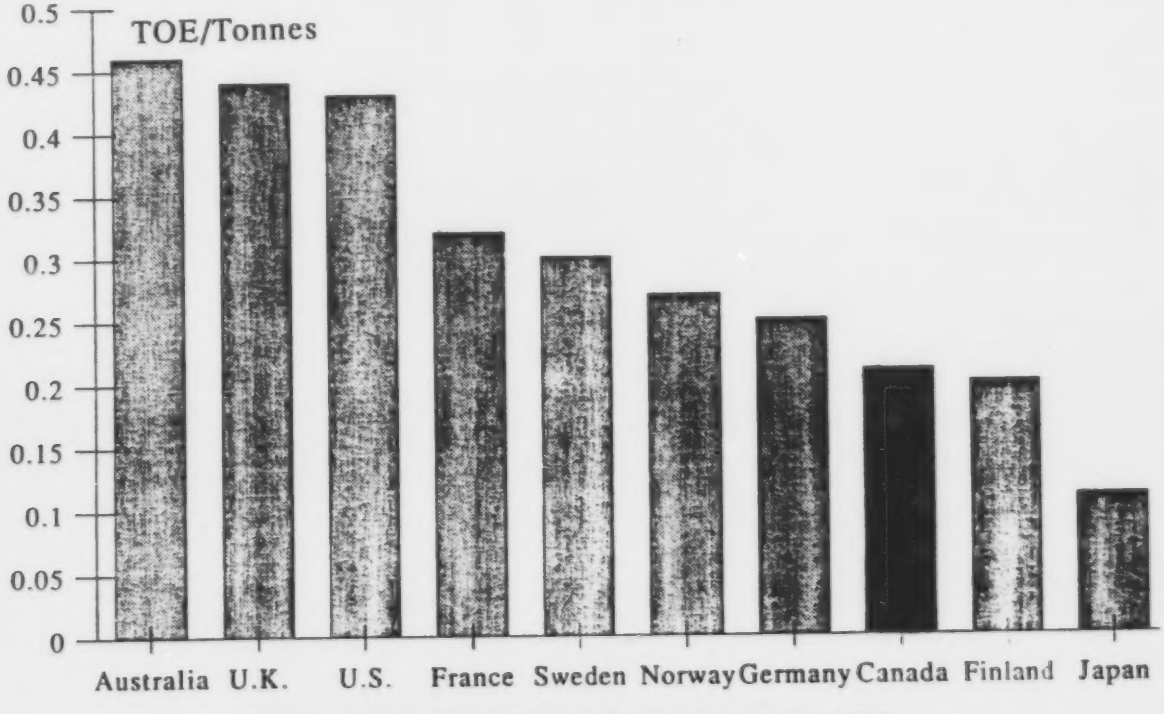


Figure 2: Pulp and Paper Industry Energy/Output Ratios (1987)

amount of energy used per unit of output produced. However, there are numerous problems with comparing a monetary out put value, such as GDP, across countries. A high energy intensity (i.e., a high energy/GDP ratio) does not imply that energy is being used inefficiently.

4.1 Energy Intensity versus Energy Efficiency

Energy intensity and *Energy efficiency* are two **different** energy utilization concepts that are presently receiving considerable attention in comparative assessments of energy use. While both these concepts relate energy utilization to the output produced, they are often used interchangeably, which usage is inappropriate.

Energy Intensity

Energy intensity is simply a measure of the amount of energy that is used to produce a unit of output. Energy intensity can be measured in a number of different ways, and at various levels of aggregation, depending on the question to be answered. For example, both energy use and output can be measured in either physical or monetary terms, and energy intensity can be measured for specific production processes, industries, sectors, or for the entire economy.

This suggests that comparisons will be more valid when conducted at a sufficiently disaggregated level to allow for similar output mixes to be compared and for output to be measured in physical terms. Hence, there should be fewer problems involved with comparisons of energy intensities for particular industries or sectors than for entire economies. Such disaggregated analyses are necessary in order to identify and understand the complexities behind the energy intensity estimates.

Energy Efficiency

Energy efficiency is also concerned with the amount of energy that is used to produce a given output. A production process is energy efficient if it uses the least possible amount of energy to produce a given volume of output. Given the concern over the linkages between energy and the environment, considerable attention is being paid to the concept of energy efficiency. Information about relative energy efficiencies in the production of a commodity can be used to identify areas in which energy use could be reduced.

Comparisons of energy efficiency are only valid when conducted at a very disaggregate level. A proper evaluation of relative energy efficiencies requires that a very strict set of assumptions be met:

(i) the composition of inputs and output must be the same, and

(ii) the array of options faced by decision-makers in the different industries or countries must be identical.

Since these assumptions are very seldom met (and never in aggregate analyses), the results of energy efficiency comparisons are always of questionable validity. However, the assumptions can be more closely approximated, the more disaggregate is the level at which the analysis is conducted.

The crucial point here is that energy efficiency should not be considered as an isolated goal. Rather, it should be evaluated in the broader context of economic efficiency.

4.2 The Relationship Between Energy Intensity and Energy Efficiency

Production decisions are normally made on the basis of economic efficiency, not energy efficiency. In other words, the goal of production decisions is to minimize the total costs of production, not to minimize the cost (or amount) of energy, which is only one input in the production process.

Production decisions are made on the basis of economic efficiency which minimizes total production costs. Energy efficiency should not be considered as an isolated goal, but rather should be evaluated in the broader context of economic efficiency. The joint attainment of energy efficiency and economic efficiency will often not be possible, but if the relative input prices are appropriate, then energy efficiency is being given due consideration. A production process that is chosen on the basis of economic efficiency may not be the most energy efficient process available. However, since the economically efficient process is the one that minimizes total production costs, it does **not** waste resources; there is a conflict between economic efficiency and energy efficiency. While the most energy efficient process would use less energy, the added costs of other inputs, such as capital and labour, could be greater than the cost of the energy saved.

Energy intensity and energy efficiency are two different concepts. Further, there is no direct relationship between energy intensity and energy efficiency. In other words, high energy intensity does not necessarily imply inefficient use of energy.

Unfortunately, while it is much easier to obtain information about energy intensity than about energy efficiency, it is energy efficiency that is usually the issue being addressed. As indicated above, there is considerable potential for inappropriate policies to be developed and implemented if energy intensity information were to be used as an indicator of energy efficiency.

I would just like to end by noting one further thing, and that is that a principal failing of this ratio is that the GDP, of course, does not yet account for the quality of the environment. Statistics Canada is doing some work now to undertake to correct this, hopefully allowing us in Canada at least to use this ratio through time to better understand the impact on the environment.

Thank you, Mr. Chairman.

Stan Hatcher: Thank you, Morgan. Our next speaker is Mr. Peter Torbet, who is with 3M Canada, Inc. Peter is also Chairman of the Canadian Industry Program for Energy Conservation. He's going to address the question of "What is the experience in efficiency and competitiveness?" Peter.

What is the Experience in Effiency and Competitiveness?

Good afternoon. I am participating at Energy Form '92, as has been noted, as the result of my involvement with the Canadian Industrial Program for Energy Conservation or CIPEC. I am currently Chairman of the Task Force Council, which is a voluntary position, with my involvement being supported by my employer, 3M Canada, Inc.

1. Introduction

I would like to address three items with my comments today. Firstly, very briefly, tell you what CIPEC is, is because I have been told many times what a well-kept secret it is. Secondly, I'll review the energy use reporting strategy that is used by the CIPEC reporting system and indicate what is shown for energy use in 1990 as compared to the base year of 1973. And thirdly, I'll consider the energy efficiency improvement that could be achievable in future, considering an extrapolation of these results, together with some brief information from other sources. And then I'll discuss what is perhaps the key issue, and that is what is restraining the uptake of energy efficiency opportunities in Canada, as I see it.

Firstly, CIPEC is a voluntary, industry-run, government-supported effort to promote and monitor energy efficiency in the Canadian mining and manufacturing industries. It was initiated in 1975 with a meeting of the federal ministers of Energy, Trade and Commerce and Environment, along with 50 senior representatives of Canadian industry, to develop an approach to address the current energy missions at that time.

Five objectives evolved from that meeting are:

1. Set voluntary targets for improving energy efficiency in each industry sector; there are now 15 sectors reporting to the CIPEC organization,
2. Report annually on issues and progress towards achieving those goals,
3. Increase energy management awareness and techniques within industry,
4. Exchange non-proprietary energy information for common benefit, and
5. Maintain an effective industry/government dialogue.

This initiative has now been operating since 1976 with various levels of interest and participation. It has been largely driven by the energy emphasis at the time. In the 70s it was a strong national imperative with forecast energy shortages. The spectre of government regulation or quotas was there, and there was obviously a very high interest. In the 80s, government moved away from regulation, the fear of energy shortages disappeared, prices moderated and, quite frankly, there wasn't a whole lot of interest in improving efficiency. In the 90s, we are refocusing, collectively, I believe, on energy efficiency from environmental and a competitiveness point of view, and the interest is increasing again.

2. Reporting Efficiency Improvements

To address the measurement and reporting criteria of the program, a common reporting mechanism was established and a lot of effort was put into it. It's quite compatible with what Morgan has just identified. Each re[illegible] company compares their current y[illegible]erformance on energy, on a consumption per unit of output basis, and compares that to the prior year's results. A change in energy productivity along with total energy used is reported and as a consequence, you can total the energy for all of the companies in the sector, and for all of the sectors, on an energy-use weighted basis. Well, the approach and results have been the subject of many discussions, it's not without problems. It deals with performance in terms of real units of energy and real units of output. For example, 3M Canada has reported, up to this point in time, on BTUs per square metre of output, although we've recently changed on a corporate basis to reporting BTUs per kilogram of output, in order to be comparable on a world-wide basis.

Some industries(cement) report on a BTU per tonne basis. The result is a unit that I can understand and relate to; it requires a minimum qualification and adjustment. The report for 1990, which represents approximately 70 per cent of the energy used in Canadian mining and manufacturing industry, indicates and improvement of energy productivity of 25.1 per cent as compared to the 1973 base year, an average improvement of 1.5 per cent per year.

It's interesting to note in 1988 it reached 28.8 per cent before the downturn in the economy, an average improvement of more than 1.9 per cent per year, over the period 1973-1988.

3. Outlook for Further Improvements

How do we extrapolate for future improvement? Not easily, is the simple answer. As part of our participation in the energy options process, as you may remember, we assessed what we had accomplished and considered the opportunities and technologies that were available, and we determined that a 1.4 per cent per year improvement was achievable, but would require a much higher level of interest than was then being offered and I think isn't currently offered today either, for that matter. This would be significantly more, for example,

than Peat, Marwick, Stevenson and Kellogg's May 1991 report, which estimated that a further 28 per cent improvement by the year 2020 was achievable, which is an average improvement of less than one per cent per year.

4. Diificulties

The forecasting process in the industrial sector has been identified as being particularly difficult, because production data and the process related energy-use are unique to each industry sector.

There's another complicating factor that applies to industry, and I'll call it the reality factor. This perception is involved in the recent strategic assessment the CIPEC Council has undertaken, and the many comments that relate to the relative priority accorded to energy efficiency improvements by industry during a recession.

That's notwithstanding industry's attempts to maintain competitiveness and maintain costs. The factor, in essence, relates to how projects are identified and implemented in industrial operations. In addition, the factor generally relates to generic technologies like heat recovery, and energy efficiency in motors with variable speed drives. Process-related opportunities are largely industry-driven by the current state of technology and competitiveness in that industry.

There's a myriad of competing priorities that affect the uptake of energy-efficiency opportunities, and with just a brief comment that the environment is also on the low-priority list. And there's two impacts there, the technical resources to minimize emissions often detract from the same resources that could otherwise be used to implement energy efficiency opportunities. And secondly, an emissions reduction program can, indeed, increase the energy requirements of a process. For example, thermal oxidizers to reduce VOC emissions.

Capital availability? It's becoming a significant constraint when you're not making any profit. But certainly competition for funds from volume growth and technology development constrains funds for retrofit energy projects. And certainly third-party financing is available, but it's not simple.

Risk? Who wants to take risk unless there's some reward? Do it right the first time is a message strong in our company, and certainly that constrains your desire to take on new and different things if there's some risk you may screw up the product by your retrofit.

Time compression? A focus on shorter product introduction time restricts the time to look at and install newer innovative technology. Whether you like to think about it or not, the imperative is to sell the product.

Competitiveness and cost? Lean and mean organizations do not have the technical resources they had in prior years to address energy-efficiency opportunities.

Knowledge? We have lots of proven technologies, but certainly the practitioner in a company needs to know them and be able to address the individual opportunity.

Competing priorities? Certainly, you like to think everything stands on its own merit, but when resource shifts to pressing issues like waste disposal, health and safety and those concerns, it's easy to lose sight of some of the other objectives.

Quality? Certainly, the risk in doing something new and different can effect product quality. And while there is emphasis on total quality management, we should have an ultimate spin-off benefit through the continuous improvement process. In the short term, it's a competing requirement.

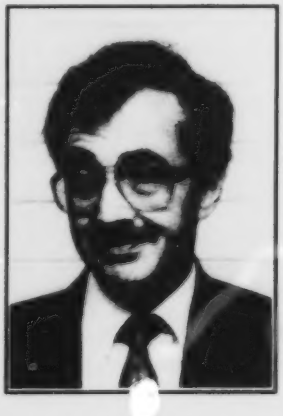
5. Conclusion

The problem is not easy to describe and it's more difficult to remedy. The simple answer is that it's a matter of priorities. The current strategic plan for CIPEC that has evolved from the assessment process, that together with some of the efforts you see from Power Smart and the utilities and other people to increase the priority and interest in energy conservation certainly will make a significant impact.

Our assessment is that if these priorities are addressed effectively, the efficiency improvements by Canadian industry could reach the 1.5 to 2 per cent per year level.

Thank you very much.

Stan Hatcher: Thank you, Peter. Our third speaker is Mr. Jack Habart, who is Manager of Planning and Evaluation at B.C. Hydro He's responsible for developing and implementing business management processes, strategic planning, program monitoring and evaluation. Prior to his current assignment, Mr. Habart was a Marketing Planner Supervisor and a work leader in the Computer Acquisition and Planning Program at B.C. Hydro. Jack previously worked with IBM Canada in their western division. Jack is going to address the question, I think, from where Peter left off. Jack Habart.



What is the Potential?

1. Background

Thank you, Mr Chairman. I'm going to give you some preliminary results of a large study that B.C. Hydro is undertaking, as part of a collaborative effort to try and determine what sort of potential we have for energy

conservation in British Columbia. We're looking at all three sectors; residential, commercial and industrial.

I would like to share with you this morning some of the initial results from our work in the industrial sector. I think it will follow very nicely from what Peter Torbet was just saying. Our objectives, assumptions and study time frame are summarized in **Table 1**.

Table 1: The Study Terms of Reference

Objective
- Estimate the technological, economic and social potential for increasing electricity efficiency in B.C. industry.

Assumptions
- Industry output
- Electricity cost
- Industry behaviour

Time Frame
- 22-year forecast period
- 1988 reference year(pre-Power Smart)

Figure 1 provides some background information on the study. We were initially trying to look at the technological limit to energy conservation, the outer limits of what could be achieved theoretically, and then by starting to add in the limitations, to narrow down to what we call the achievable limit.

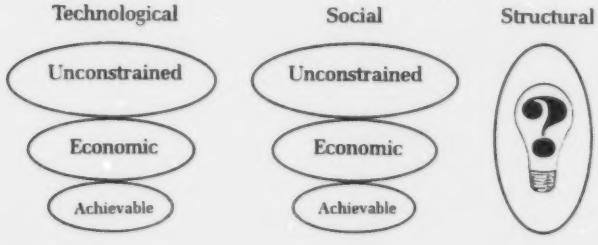


Figure 1: Scope of the Study

2. Definitions

The technological limit can be achieved by basically changing the technology industry-wide. For example, by replacing every standard efficiency motor in British Colombia with the most energy-efficient motor available. And that's really the outer limit.

The next criteria to be added is economics. As the panel stated earlier, you only do this if it makes good business sense. What you then do is to ask, "For how many of these motors we changed is there really going to be a payback to society and to the company in question?' Finally, look at all of the restrictions or limitations Peter Torbet was talking about; capital availability, interest, awareness, that sort of thing, to finally come up with what we call an achievable potential.

The other thing we looked at in the study, which I think is interesting, is that as well as replacing the equipment, the hardware, we also wanted to take a look at what we called the social potential. And that's a relatively innovative idea for this kind of study, and what it means, in the case of the residential sector, for example, is that we're looking at the behavioural impact. How much energy can you save if you can get everyone in the residential sector to turn out the lights when they leave the room? In the case of the industrial sector, what you're really talking about here is adopting the best operating and maintenance procedures. So, that's basically what we were trying to estimate; how much of the achievable technological efficiency improvement would actually wind up being adopted.

Finally, we have the structural potential, which is the impact of totally-new technologies on our society, such as a breakthrough in storage battery technology which would make the widespread adoption of electric vehicles for commuting possible. Or a breakthrough in hydrogen storage technology for vehicles. We have to keep an eye out for such possibilities.

3. Technological Potential for Industry

Where we are in the study now is we've basically quantified the technological potential and the economic potential for industry. The proportion of electric energy presently consumed in the major sectors of the industrial load here in B. C. is shown in **Table 2**. Over the next six to nine months we'll be estimating the achievable potential for efficiency improvements in these sectors.

Table 2: Industrial Sector End-Use Consumption

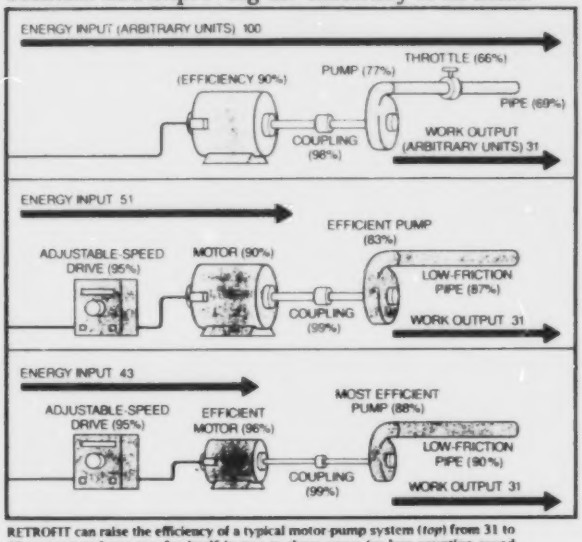
Pulp and Paper	53%
Mining	17%
Wood products	10%
Chemicals	8%
Petroleum refining	2%
	90%

Study Focus: Consultants work covered the five industries which account for 90% of B.C. industry's electricity consumption.

Research Priorities: Focus on motive force equipment and electrolysis; 80% of total industry end-use consumption is covered by the report analyses

Essentially our approach was to disaggregate all of the industrial processes into their component parts. In **Figure 2**, for example, this may be a pumping situation, where you have a motor, a drive, a pump and then whatever restrictions such as the physical carrying capacity of the pipe that you're pumping the liquid through. And you look at what the standard industry practice is now, what's typically installed now, in terms of efficiency, for each of those components. And then you hypothesize. What's the most efficient technology you could use at each point?

This particular example is from an article in the September 1990 issue of *Scientific American* which showed that if you fed100 units of energy into a pumping system, you'd typically get about 31 units of work output. By improving the technology, the input drop as low as 43 units of energy and still produce the same 31 units of output. This is very much what David Scott was talking about this morning, holding the energy service constant and improving the efficiency to its limit.



RETROFIT can raise the efficiency of a typical motor-pump system (*top*) from 31 to 72 percent and can pay for itself in two to three years (or less counting saved maintenance costs). An electronic drive (*middle*) affects the efficiency of the other components. Here the drive's net effect is a 21 percent savings, not counting lower pipe losses. A more efficient and properly sized motor and pump, as well as better pipes, saves even more (*bottom*), partly by fixing the damage caused by improper repairs to the old motor. Further refinements may cut energy use by 40 percent.

Figure 2: Mechanical System Efficiency Improvements

That's basically the approach. And what did we find? Briefly, I'll jump ahead and show you some of the results in **Figures 3** and **4**. We looked at the expected load growth from 1988 to the years 2000 and 2010, and came up with a number of different forecasts based on how we thought total industrial electricity consumption would grow under six different scenarios.

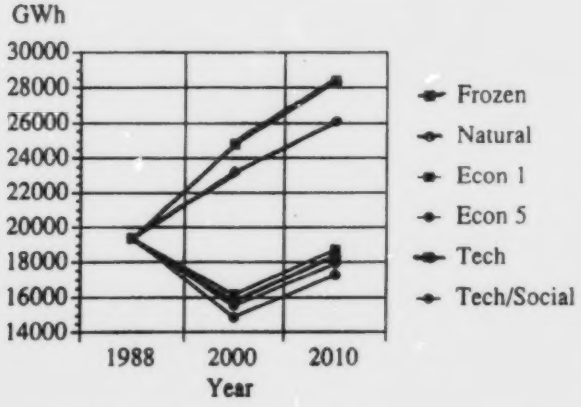


Figure 3: Efficiency Forecast High Consumption Case

Referring to Figure 3, for a high-growth scenario, what we've shown on the top line here is what's called the frozen-efficiency energy requirement, which says, let's just keep that number of kilowatt hours per pound of aluminium constant or the number of kilowatt hours per ton of cement constant, and just grow the electric load based on the expected growth in product output. And that gave you a growth something like this, from a little under 20,000 GWH up to about 28,000 GWH.

We looked at it and decided to assume that more efficient motors are adopted just as the capital stock turns over, and that there will be no other changes in industrial decision-making behaviour and no programs like Power Smart. What happens to the energy requirements? As shown on the second line in Figure 3(Natural Improvement), the model delivered about an 8 to 9 per cent reduction by 2010. This is what happens if people replace old motors with more efficient current models.

The study got interesting when we start looking at the technical potential. And what you see, in the lines grouped at the bottom of Figure 3, is that a fairly significant reduction in energy requirement is possible. It's interesting to note that we ran a number of sensitivity studies using a range of growth assumptions, and all the results were, in fact, quite consistent regardless of the growth pattern assumed.

We hypothesized a range of environmental credits to gauge the impact on consumption. Suppose the price of electricity was increased by 15 or even 30 percent to encourage conservation. In fact, we went up to a 100 per cent premium, the equivalent of doubling the energy cost, to see what change in efficiency could be expected as a result. Very much to our surprise, everything clustered very close to the technical potential.

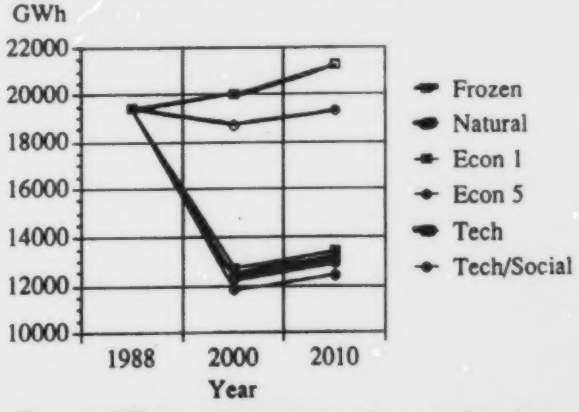


Figure 4: Efficiency Forecast: Low Consumption Case

We tried the same thing under a low future industrial growth rate with essentially the same result, as Figure 4 shows. That was a bit of a surprise. I had actually expected to find that as the price increased, more of the technologies would become economic. The

graph says that the technologies we looked at today, which are things that are available either now or are expected to be fairly shortly, are for the most part, economically viable already. You don't need an environmental premium to encourage people to adopt them.

I think that really reinforces some of the things that Peter was mentioning earlier, which is that there are a number of other barriers that are restricting the adoption of efficiency improvements.

I'd like you notice the social potential. Again, this turned out to be a bit smaller number than we expected, the social potential being how much additional conservation would you get from adopting the best operations and maintenance practices. But I should point out that social potential was calculated after the most efficient technologies were installed, which may help to explain why that number was smaller than expected.

4. Results by Energy Sector

Let's see how some of that efficiency potential looks when it's broken down into different types of end uses. We assumed that the major industrial uses for electricity were pumping, air compression, air displacement (fans, pumping wood chips, etc.), conveyors and direct process machine drives. **Table 3** shows that the areas with the biggest potential are the first three: pumping, compression, and air displacement. By adopting more efficient technologies, more efficient motors, going to variable speed drives and so forth, fairly significant efficiency improvements are possible.

Table 3: Aggregate End-Use Efficiency Improvement Technological Relative to Frozen

End-use	Technological % Reduction relative to Frozen
Pumping	60
Compression	50
Air displacement	48
Conveyance	20
Direct process machine drive	13

This same information is shown from an industrial sector viewpoint in **Table 4**. This indicates that the biggest potential energy savings are in the pulp and paper industry, mining, wood products and chemicals. Petroleum refining offers a saving of 60 per cent; fairly large in terms of a percentage, but it's a fairly small industry here in British Columbia, so that from a total energy reduction point of view, it is not a big target. I would like to stress again that you must remember that these are the theoretical values. These are the outer limits that you could go for. The industrial sector assumptions used in the study are detailed in **Table 5**.

We must now with is to look at all the barriers now in place to try and come up with some idea of what will be potentially achievable over the next 20-year period.

For those who are interested, the study is a collaborative effort amongst a number of stakeholders, including the industrial, commercial and residential sectors and environmental groups, under the sponsorship of B.C. Hydro and West Kootenay Power.

Table 4: Industrial End-Use Efficiency Improvement (High Output-2010)

Sub-sector	Technological % Reduction relative to Frozen
Pulp and Paper	42.4
Mining	24.6
Wood Products	19.3
Chemicals	23.2
Petroleum refining	60.5
Other Manufacturing	38.5

Table 5: Industrial Sector Assumptions

1 **Estimates of Motor Systems**
- comprehensive analysis of motor system components
- increased comprehensiveness led to some loss of accuracy in forecasting due to lack of existing data

2 **Investment Behaviour**
- initial calibration demonstarted over-estimation of market potential for efficient motors
- resolution: constrain penetration of energy efficient motor systems to 20% of market

3 **Operation and Maintenance Behaviour**
- one ISTUM model run assumed standard behaviour; the other run assumed best behaviour

4 **Environmental Credits**
- range of credits (15, 30, 60 & 100%) incorporated into the cost of new supply to account for environmental externalities

5 **Sub-System Focus versus Plant Focus**
- sub-optimization; focus on individual pieces of technology

When these results have been reviewed by these different stakeholders, and are generally agreed upon by them, the results will be published, probably over the next couple of months. The report will be available shortly for anyone who wants to take a further look at it.

Table 6: Summary of Study Results

- Total technological and economic potential: 34-37% decrease in consumption
- Addition of social potential to technological: 39-42% decrease in consumption
- World without Power Smart: 8-9% decrease in consumption
- Phase I succeeded in producing electricity conservation potential estimates for the Industrial sector

5. Summary

I'll summarize by reminding you of my caveats

that we're talking about outer limits of efficiency improvements that are technically possible for B.C. industries. These are summarized in **Table 6**. Looking at B.C. as a whole, we see the outer limits as somewhere in the range of a 34 to 37 per cent energy reduction. Adding the social potential, you'd get into the 39 to 42 per cent range. That's not totally out of line, I think, with the sort of gains that Peter Torbert was talking about.

Thank you very much.

Stan Hatcher: Thank you very much, Jack. Well, ladies and gentlemen, I'm sure that you have quite a few questions and comments on this topic. Let me start by asking a questions addressed to both Morgan MacRae and Peter Torbet: "From all of your studies, the question is, is Canada an energy glutton?. What is the impact of energy intensity, particularly as embodied in manufactured goods on the assessment?"

Morgan MacRae: Well, I'll just try to respond to the first question. No, I don't think that Canada is an energy glutton. If you have decision-makers around the world who are making the best decisions in terms of the resources that they have, energy, capital, etc., then it makes sense that Canada should be a major producer of pulp and aluminium, etc., as these industries are energy-intensive and we have the energy.

That's today. I think its obvious that in the future, with the energy improvements being made by the OECD, that the current ratios will change, perhaps markedly.

Peter Torbet: What is the impact of energy intensity, particularly as embodied in manufactured goods on the assessment? I can only speak to it in a general sense. I am, I guess, a typical practitioner in an industrial manufacturing operation. And my sense is that Canadian industry is as efficient and effective at utilizing energy as is industry in any other country.

The products Canadian industry produces are a consequence of our lifestyle and are embodied in the things we want to consume and the services we wish to acquire, as the speakers this morning discussed. A lot of the things the industry has provided are what the consuming sector asks it to produce. You sell to them and they buy. So, I think that our manufacturing sector here in Canada is as efficient as any other manufacturing sector. Our market is smaller, and that affects the size of our manufacturing base, and that in turn may affect our costs and prices you pay.

Bronwin Boulton: I'm not sure who to ask this of, so perhaps the panellistss could think about who should respond. We're talking about energy efficiency and the reduction of demand. From my reading, it appears that producing aluminium from recycled material uses about one-fifth of the energy required to produce aluminium from the raw bauxite ore.

I'm hearing a lot of ideas about energy efficiency and reduction in our use of electricity, but yet here in British Columbia we're planning, (not 'we' as environmentalists, but 'we' as B.C. citizens) on building a dam that is going to provide power for the production of aluminium. Maybe we don't really need that dam if we recycled more of our aluminium. Now, there are other recycling options out there that will also result in net reductions in energy use. And I wonder if any of the panellists can comment our need for new mega-projects when we have this potential for energy reduction right here, and I must say, a consuming public more than ready to accept recycling.

Stan Hatcher: Thank you. Morgan, would you like to start on that one?

Morgan MacRae: I'll try. I'm not sure what the situation is within British Columbia. But the questioner is right; it does take a lot less energy to recycle aluminium, re-refine it, and use it over again productively, as with copper, steel, etc. And as you go down the list, I guess paper is actually one of the least efficient things to recycle. But I cannot dismiss the fact that aluminium should be recycled where practical and possible.

The more aluminium you gather up to recycle, the more it costs. There's a need both for recycling for aluminium and in the particular case of B. C., the need for a new, as you term it 'mega-project' at Kitimat that will be used to build additional aluminium capacity. Both are going to be required.

Stan Hatcher: Perhaps an element of the answer to that is how much of Canada's aluminium production is used domestically and how much is exported at the moment. Does anyone have the answer to that?. Anyone in the audience have the answer to that, because I think that's a part of the answer to the question, in a sense. No aluminium experts here?

Voice from the Audience: A very small percentage of our aluminium is being recycled. Most of Canada's production is being exported.

Stan Hatcher: I agree, very little is recycled. I was trying to get at what is the potential is for recycling. Is 95 per cent of the aluminium that Canada produces exported? In which case, the domestic recycling potential won't have a big impact on the aluminum industry.

Cecil Kelly: You know, I think that the whole issue of conspicuous consumption, that we pride ourselves in the western world, is the culprit here. I believe that everything that can be recycled should be recycled, thereby saving the energy of making the product out of the finite raw materials in the ground.

The problem in our communities here is that we want to recycle all of our recyclable items because the

companies can make more money by using raw products without having to go through the recycling process. So, until there is a recycling program established and enforced all over the western world, we're going to continue to waste energy supplying our throw-away society from all these raw materials.

Stan Hatcher: That's a good point. Thank you.

Peter Torbet: Can I just make a comment. Certainly, from my perspective, in light of the discussions I've had with our industrial customers, industry is strongly focused on optimal cost manufacturing, and if there are some manufacturing opportunities at a lower cost using recycled material, I think you'll see that recycling will develop further.

Unfortunately, I think we do live in a capitalist system. It's not a bad system, quite frankly, but there is some give and take in it. Another factor you can't ignore, and a good reason that companies are staying away from recycled material, is the quality of the output. You need one only china cup in a load of glass bottles, for example, to make a bad batch of glass. And if you have product liability facing you, you're not very enthused sometimes about being a pioneer. Those are some significant quality issues in the manufacturing process to remember.

I think there's a very integrated and complicated series of trade-offs on the recycling and energy-use issues.

Stan Hatcher: Here's a question that perhaps is not directly related, but I think it does deal partly with this social question. The question is addressed to all our panellists: "Efficiency can be improved through persuasion, regulation or pricing. Is there a need for more stringent regulation to 'encourage' efficiency to occur more rapidly? Do we need more stringent regulation to encourage efficiency?"

Jack Habart: It's an interesting question. In my view, certainly one of the significant differences between the United States and Canada is their willingness to try and introduce changes through legislation. I'm sure you're aware that in the States they have attempted a number of times to use legislation to change common practices. To my mind it hasn't always worked that well.

In the Pacific Northwest, for example, they tried to introduce energy efficient homes by legislation. That resulted in something like a five-year lawsuit between the Seattle Master Builders Association and the State of Washington.

In Canada, we have tried as much as possible to use market mechanisms to lead the market, make the products available, do things like training builders in better home-building techniques and basically lead the market that way rather than try to force it through legislation.

Peter Torbet: Certainly, it's been an item of discussion at our council in terms of the potential for doing something by regulation rather than using persuasion. The problem with regulation that we've come around to many times is the by-products and the spin-offs of that you didn't anticipate. It's very, very difficult, in my mind, to legislate energy efficiency. To correctly anticipate all the benefits in terms of the market forces and consumerism, etc., is an extremely high risk venture.

Morgan MacRae: A further comment to the question, "Do we need more regulation?" I think the fact is that we're going to get more regulation because of people's concern about with toxic chemicals, ozone, CO_2, urban waste streams, etc. I think that the use of market instruments together with additional regulations is probably the way to go.

I've been hearing for sometime Environment Canada is supposed to be releasing a white paper on economic instruments, and within Alberta a study on economic instruments including the NUGs (non-utility generation) has just gotten under way. It's focus is to decide what are the three best economic instruments to use in looking at developing targets for greenhouse gas emissions. So, maybe this will give us an answer in which we can meld the two; legislation and the use of market instruments.

Stan Hatcher: This next one is a good provocative question, it's addressed to Morgan, and I think it really gets to this question of what sort of industrial society are we going to strive for in Canada. It reads: "How can you make the statement that we are not energy gluttons from an international perspective when Canada uses 20,000 kilowatts per person per year, and China uses less than 1,000 kilowatt hours per person per year".

Morgan MacRae: In Canada, we have a lot of energy-intensive industry and a relatively sparse population. China has the opposite; 40 times our population and not much energy-intensive industry. Does that make us energy gluttons?

I guess the counter-question to consider is whether you'd want to be in the same situation that China is in right now, where the Chinese have aspirations to achieve the same standard of living that we enjoy in Canada.

To raise a couple of thoughts that were presented this morning, one of the biggest concerns I think we should all have is over what China is going to do with an increasing per capita use of electric power or of all energy forms? Moreover, what will be the multiplicative effect of the phenomenal increase in population we're likely to see in China between now and the year 2050?

I think aspirations on both sides have to be melded here somewhat. Canada does use a lot of energy on a per capital basis. That's where we are now. If we initiate

actions which a number of government departments are looking at and organizations across Canada to reduce greenhouse gases, we will not be in the same position as we are now ten years down the road. Whether we will rank the same relative to China ten years down the road, I think, is anyone's guess.

Stan Hatcher: Here's one is for Jack: "What's the difference between the technological and the achievable potential?"

Jack Habart: Okay, the technological potential, as I tried to explain earlier, is really tbe outer limit; what you could achieve if you could exchange every item with the most efficient replacement available. The achievable potential is what you could reasonably expect to get, given the I guess what I would call the realities of how business works.

You have to start including things like awareness and information about the products, availability of products. As Peter was saying earlier, one of the major constraints, I think, is capital availability, especially during an economic downturn. Certainly, I think anyone here who is associated with industry will be aware that industry uses a relatively short payback period, relative to what B.C. Hydro uses. Industry looks for something like a two-year payback during an economic downturn, sometimes even a one-year payback. I've talked to a number of people in the industry who have a whole list of things that meet the one- or two-year payback criteria, but can't get approval to go ahead with them simply because the money is not available today.

We have to start looking at all those real world constraints and asking, when we're forecasting B.C. Hydro's additional electricity requirements for program planning, how much can we realistically hope to achieve over the next ten years or twenty years?. That's really the difference between what I call the 'technical potential' and the 'achievable potential'.

Stan Hatcher: Here's one for Peter : "In improving energy efficiency, what impact will it have on productivity improvement in terms of gross income?"

Peter Torbet: I don't know if I can address gross income, but certainly in the company I work for, energy cost is a very small component of our total costs. However, in some industries it's a very high component of cost, as in the cement and glass industries, for example.

What you're going to see is that energy efficiency can have a dramatic impact on your bottom line based on the percentage of your manufacturing cost that is energy-driven. So, certainly improved energy efficiency can improve the competitiveness and can improve the operation of that company, but a lot depends on the relative impact.

I can only speak for the company I'm with and we have a target of a 20 per cent improvement in energy efficiency, or energy cost per unit of output, by 1995. And our energy bill is only about one per cent of our factory cost. But we think that's significant, and we think it's a target that needs to be achieved to maintain a competitive position.

Stan Hatcher: This one's for Morgan: "In your opinion, what would be an appropriate international measurement to judge energy efficiency and intensity among the OECD countries, the developing countries and between OECD and the developing countries?

Morgan MacRae: Just to clarify in the presentation I made, the energy/GDP ratio right now is being used both as a measure of energy efficiency and as a measure of energy intensity.

Firstly, we concluded that it is a very poor measure of energy intensity and, secondly, that it should not be used to infer energy efficiency at all because that requires a very disaggregate analysis in order to undertake that or in order to make that comparison.

Personally, I don't think there's much significance in looking at aggregate levels of energy efficiency across boundaries. As I suggested, what we concluded, in a qualitative sense, in looking at these measures across countries, is that there are good reasons for the energy/GDP ratios that we have now or whatever other ratio that you would chose to look at.

What is probably most important if we are to solve a greenhouse gas issue in the future is how each individual country goes about cleaning up its own house, if you will. Therefore, any efficiency index or any energy-intensity measure is a useful thing to be looked at within the confines of a particular country. Even within a country, there are problems. Looking at energy use per GDP across Canada, there's such a difference between provinces that I think it makes equally little sense looking at that ratio for the provinces of Canada as it does for Canada versus various countries in the OECD or developing countries.

What is important is that we do something within the various provinces, those people whose jurisdiction it is to clean up the environment, we go about doing it and we look at percentage changes or movements within those jurisdictions to improve greenhouse gases.

Stan Hatcher: Jack, here's another provocative one: "Do you foresee any Canadian utility commissions decoupling profits from the cost of power production, as is happening in the US? If so, when?"

Jack Habart: It sounds like a set up. Was that submitted by the B.C. Utility Commission (BCUC) representatives, by any chance? Okay, I should explain for

maybe a little bit of background for people who aren't up to their armpits in these kinds of issues.

One of the things that's happened in the United States, that bastion of privately-owned power utilities, is that during the 80s, it was realized that one of the real barriers to the support of utility conservation programs was the simple economic fact that for a privately owned utility, the more energy you sold the more money you made; and the less energy you sold, if you were successful with your conservation programs, the less money you made.

What is really starting to happen in the United States is that the regulatory authorities have moved to decouple profits from the actual level of sales. This is happening to a significant degree in California right now, and it's being viewed as a way to significantly encourage an increased level of utility conservation programs. Based on what we're seeing for budgets out of the California utilities, it probably will be successful, at least over the short term. However, there is a lot of concern on the horizon about whether these mechanisms really do generate efficient utility operations.

In the case of B.C. Hydro, I don't foresee the B.C. Utility Commission doing any sort of decoupling because we're not rate-base regulated, as are the privately-owned utilities. In terms of the other utilities, I don't see quite the same level of pressure in Canada to go that route as there is in the States, and I suspect there may be a tendency to move a little slower in Canada. We'd like to find out how these decoupling mechanisms really work in reality, after two or three years of experience. But that is just my personal opinion, I might add.

Question from the Audience: Jack, can you give an example of how the American regulatory authorities cost out the actual efficiency that a utility achieves?

Jack Habart: The first thing is that's happening in California right now is that the efficiency credits or incentives are being paid on the **projected** level of efficiency savings, on the projected level of load reduction. They are currently working on defining standardized methodologies to try out, where estimates will be compared to the the actual reductions. There are a number of those kind of measurement problems; a long list of such problems is starting to show up in the literature.

Stan Hatcher: This next one is also addressed to you, Jack: "Why the lawsuit between the Washington State legislature and the Builders Association over energy efficient housing?"

Jack Habart: I'll try, but I have only a superficial knowledge of it. But basically they were attempting to legislate building standards in the Pacific Northwest, in the early 80s, which raised the initial cost of the buildings. The builders were objecting that this was not cost-effective to society and they launched a fairly major lawsuit, which as I recall, took about five years to resolve in the Seattle area. So, that was basically the background to it. I beleive that the Master Builders lost their lawsuit in the end.

Stan Hatcher: Does anybody know who won?

Voice from the Audience: The lawyers.

John Reynolds: I have a question for Jack Habart. Having just flown over this land today, from Labrador to British Columbia, I was struck by the lack of strong east-west electrical interties across the country. Now, wouldn't there be great advantages from an efficiency point of view in being able to share the peak load by making use of the diversity across the time zones? You wouldn't have to put so many generators into each province. There should be some sense and advantage to this idea. I feel it has been studied, but when was it last updated?

Jack Habart: The basic idea is, can you do load-balancing simply because of the change in time zones? Although I'm not a transmission planner, I'm aware that certainly what's happening today is energy changes are flowing north and south through the grid interconnections. And what you are really trying to do there is the same kind of balancing between winter-peak utilities, which we tend to be here in Canada, and summer-peak utilities in California. So, the same basic principle but because of the population densities, I suspect it's economically a lot more sensible to look at north/south interconnections rather than an east/west grid.

Cecil Kelly: That's what locked us into the Free Trade Agreement.

Jack Habart: No, the energy interchanges were happening long before the Free Trade Agreement. I'm sorry, I'm not an expert on free trade and energy, but certainly we were doing energy trades prior to the Free Trade Agreement and I don't believe Free Trade had a big impact on it.

Cecil Kelly: According to my understanding, under the Free Trade Agreement, we would no longer be able to interrupt any firm export contract, we would no longer be able to withdraw any power that we're exporting south on a firm basis. Whereas if we had an east/west grid we'd be able to exchange that power and not have to be locked into firm contracts. If I'm incorrect I'd like to have some direction.

Voice from the Audience: We would have to agree on free trade between the provinces before you could think of east/west power exchanges.

John Beddome: Just to reinforce Mr. MacRae and his answer to the questions of recycling and is Canada an energy glutton? Despite the distances we are apart and

the temperature of our climate, we've been able to achieve an enviable living standard; and we're in the position that we're able to sell copper, zinc, and aluminium, all at a considerable cost in electric power, to the rest of the world for a profit.

If there has to be an inventory, consider that even if we were able to recycle all the aluminium consumed in Canada, there would still be a very largeworldwide demand. If every Chinese aspired to one-tenth the aluminium Canadians now use each year, there'd be a huge aluminium market for 100 years. Should that be provided out of China or do we provide it out of Canada?. If we provided it out of China, the power of choice would probably be coal; whatever the bad effects of coal are, they're going to circulate worldwide. I guess whatever the bad effects of producing aluminium are in Canada, they're going to be spread over many fewer people, and over a much larger area. There are trade-offs there.

If we were energy gluttons, I think we'd refuse to let the rest of the world share the benefits of the energy resources we do have.

Jim Sloan: My question is about the voluntary approach to energy conservation adopted by some companies. Assume there's a company, or a number of companies, that are in a position where they monopolized a certain product market in a particular region, excluding the international markets. I'm thinking of Canada and the United States for this particular product. Now, if your production energy needs could be decreased by up to 90 per cent by using recycled material, as in the case of the aluminium industry, and if you are facing major capital investments to increase production, would it not make more sense to turn around and make those major capital investments in the recycling area, where energy needs are lower? What would you say to legislation that would stop them from doing that?

Peter Torbet: You're presuming there's not another innovator around that isn't smart enough take advantage of that market opportunity?

Jim Sloan: Definitely.

Peter Torbet: I disagree. I'd like to believe that in Canada there would be. You imply that they're not going to do it because they have a cartel, and why should they? I think there's enough people around that would take advantage of the saving by going the recycling route that would quickly move them off their comfortable position if that were, indeed, the case.

I have a fair bit of faith in the capitalist system, opportunity, innovation and individual entrepreneurship, and I think they will eventually solve the problem of which is best, to recycle or to manufacture from new raw materials, and will develop the opportunities.

Duncan Taylor: I'd like to add a word on the discussion about the advisability of using regulation. I'm Duncan Taylor, from the Ontario Ministry of Energy, and we see regulation as being a significant contributor to achieving future efficiency improvements in energy use as, in fact, have already been achieved in Ontario.

Ontario was the first province in Canada to pass an Energy Efficiency Act. Other provinces and the Federal Government have since adopted similar legislation. And that gives us the authority to set standards and minimum performance for some, I think, 14 specified appliances under the general category. These standards are set in cooperation with the standard-setting bodies, the Canadian Standards Association, the CGSB, and have resulted, I think, in something like a 40 to 50 per cent improvement in power use. This standard for new refrigerators will become the minimum standard that can be sold by about 1994, I think.

Similarly, we've tightened the Ontario Building Code, as many other provinces have done. There are many minimum efficiency standards for new housing set through the building code, and we propose to toughen them gradually through time, again, in cooperation with the affected parties, the builders, as in the case of the Energy Efficiency Act with the equipment manufacturers.

Jack Habart: Let me clarify my earlier answer. I think I may have misstated my position. I wasn't trying to say that there is no role for legislation in standards. On the contrary, I'm sure there is. The point I was trying to make was that in Canada I think we tend to not try and drive the markets with legislation, but rather what we try and do is to get the market mechanism to introduce the products, to introduce the training and that sort of thing, and then we use legislation to follow up and set new minimum standards. I certainly didn't intend to say that there's no role for legislation and regulation.

Stan Hatcher: Let me just introduce one very technical question into the middle of this, and it's addressed to all of the panellists: What's the role of artificial intelligence and information technology in achieving efficiency improvements?

Morgan MacRae: I'm not aware of anyone using artificial intelligence or neural networks specifically to achieve efficiency improvements.

Peter Torbet: To my knowledge, no. But certainly if it helps the monitoring, measuring and control techniques, it will find its place in due course.

Ray Hunt: Many of the applications of artificial intelligence in today's technology are more on the supply side. At B.C. Hydro, we have used neural networks and artificial intelligence to improve the efficiency on the supply side of our generating system, thus making more energy available through the hardware.

Cecil Kelly: On that last question, I think you could say that our market-driven society and our consumerism could be described as artificial intelligence.

But let me get back to what I wanted to comment on. We've heard a lot from people with this cavalier attitude that I'm proud to be from an area that consumes so much energy and why would I want to live in China or Mexico, and live in the conditions that these people are forced to live in who consume so little energy?

Well, I for one think that we're living in a dream world if we think that everyone in our society isn't going to have to change their way of living in order for us to meet the challenge of the future. It's not a question of what is economically right or what is achievable, is, it is a question of what is essential today. Now, today, all day I've heard people banter around these figures, you know, billion dollar figures in terms of profits, in terms of what we've earned, what the capacity of Canada is to supply the world with these raw materials. And I also work for the Lheit-Lit'en Nation in Prince George, a nation of people who suffer 65 to 85 per cent unemployment and who use just as much energy, or I should say just as little energy as the Chinese or any of the third world countries.

My question here is that, my point that I'm trying to make here is that it is not right for us to continue to monopolize the resources of the people of this country, or the people of this world for that matter, to benefit a few. We have so much energy, we have so many raw materials in Canada that more than just a few people should be sitting around discussing this issue.

Those profits do not get down into the hands of the people who need it most, nor do they in any other country. I'm a bit of a student of history and as I sit here, looking at these nice marble walls, I recall wondering as a child how Nero could sit around and fiddle while Rome was burning. And now I see us fiddling here.

Stan Hatcher: Thank you. Anyone like to make another comment on that?

John Beddome: I have one comment. If we pursue a lot of these things to the ultimate, we would end up by closing down Canada and letting the rest of the world take over, as we try to save the rest of the world by conserving everything we have.

Stan Hatcher: To sum up, I think the points made by the last two speakers really illustrate the diversity of opinion and the complexity of the issue of 'Efficiency and Competitiveness' that we have been discussing this afternoon. A good question to ponder is just what sort of social system Canadians want. Do they want to be competitive in the global economy of the future?. Or do we want to revert to a totally different lifestyle than the one that we have at the moment? And perhaps that's one of the most important questions that's been brought out in the discussion here.

The one common theme that we've heard from our panellists in addressing the question of energy efficiency is that there are no simple overall methods to compare energy efficiency on an aggregate basis. You really have to get down to the fine detail and examine different industries, different products, different processes in the production of these products if we want to improve our energy efficiency.

We certainly had a good discussion on the importance of recycling and how much energy efficiency we can gain by recycling rather than producing goods from raw materials.

There was quite a bit of discussion on the need and the role of regulation in improving our energy efficiency. I think perhaps one of the more encouraging things is that it's a common theme from our speakers that once we set our mind to it, we can, in fact, improve our energy efficiency quite substantially. And we saw that numbers like 20 to 30 per cent are possible in the very near term.

Since we are at the end of our time, I would like you to now join with me in thanking our speakers. I think we've had a very good panel discussion. We've had some good stimulating and provocative debate, which I think is important. So, thank you very much, speakers. And thank you out there in the audience. We'll adjourn now.

Panel Discussion: Energy and Competitiveness

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Panel Discussion

Energy and Competitiveness

Panellists
Duncan Taylor
Leo Flaman
Carl Beigie

Introduction of Panellists by Stan Hatcher

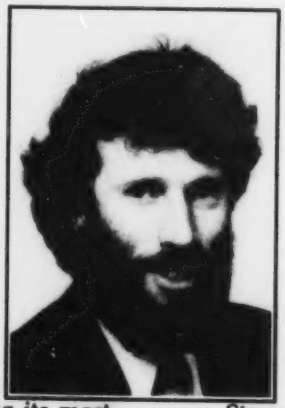
Good afternoon, ladies and gentlemen, welcome back to the final part of this afternoon's program, which will be in the form of a second panel discussion.

Our first speaker is Dr. Duncan Taylor. Duncan is the Manager of the Economics and Forecast Section of the Ontario Ministry of Energy. He holds a doctorate in Industrial Engineering from the University of Toronto. He joined the Ontario Government as an economic analyst with the Ministry of Health in 1978; he's been with the Ontario Ministry of Energy since 1980, and was appointed to his present position in 1989. Please welcome Duncan Taylor.

Energy Efficiency in Industry: Ontario's Experience

1. Introduction

Good afternoon, ladies and gentlemen. The theme of this session is energy and competitiveness, and my aim is to explain Ontario's approach to helping industry in this quest through energy efficiency. I'd like to address first the current competitive challenge and how Ontario's energy policies are directed to meeting that challenge. Then I'll cover some of the specific industrial program activities we are undertaking, and their results.



It's well known that Ontario is facing its most serious economic challenge since the Thirties. Trading patterns are changing rapidly, industries are restructuring, and competitiveness is being tested increasingly in global markets. Looking at the last two years, it is no indicator of conservation success that energy demand in Ontario fell by over 6 per cent. Not when the economy suffered a combined 4 per cent drop in output, and some 300,000 jobs have been lost. Manufacturing has been particularly hard hit: output is down over 11 per cent in two years, with energy-intensive industries like steel and newsprint among the worst hit.

The reduction of aggregate energy consumption and energy intensity is irrelevant in a situation like this. We recognize that energy use will rise again when the economy recovers, but we'll have to work our way back to economic health, and our aim is for energy policy and programs to contribute to this. With forecasts of economic growth approaching 4 percent starting later this year, increased investment in machinery and equipment is projected to be a key feature of the recovery, helped by recent corporate tax changes. We want to seize the opportunity of investment growth to build in energy efficiency and cost reductions into this new capital stock.

2. Ontario's New Energy Directions Policy

I'm glad to say we have put in place the means to meet this challenge. Ontario's New Energy Directions, which were announced in November 1990, set energy efficiency and conservation as the first priorities in meeting our energy needs. They recognized that the traditional approach of concentrating on the availability of supply is quite inadequate. Policy and programs have to be led by efforts to improve energy use.

Stronger government leadership was announced, through expanded programs, regulations and supplier development initiatives. Ontario Hydro has greatly expanded its efforts in demand management. To help ensure reliable electricity supply, increased emphasis was given to non-utility generation and renewable sources.

For industry, the Ministry of Energy has begun a series of programs to promote energy efficiency, and to help improve industrial competitiveness through reduced energy costs. Partnership with industry is one key theme; another is flexibility to accommodate different client needs.

Since 1987, our Industrial Energy Services program has provided advice and assistance to over 700 companies. The program has three phases: free audits by a consulting engineer, feasibility analysis grants to examine the opportunity more closely and, lastly, project engineering grants.

In its first four years, the Ministry completed some 460 energy audits covering over $500 million in audited energy costs. This was about 20 per cent of the prov-

ince's total industrial energy consumption, and with another year's experience, a full one-third of the total has been covered.

3. Results

The results are very encouraging: on average the Ministry can help an industrial plant cut its energy costs by 10 per cent. These are savings in existing operations, and naturally are lower than those estimated for new plants or major process changes. Comparing across sectors, the largest savings potential – over 14 per cent – was found in the transportation equipment, paper, wood and plastics industries. A lower potential, of around 5 per cent, was found in mining and milling operations and in non-metallic minerals. This suggests that the companies in these sectors have already made the most cost-effective savings on their own.

The identified savings are very site-specific in equipment and process improvements. The four most common measures are process heat recovery, electrical demand control systems, design modifications, and process equipment replacement. Short payback periods are striking; almost two-thirds had simple paybacks less than 2 years, and only 5 per cent exceeded 5 years. In planning the audits, the Ministry's engineers and the plant managers naturally concentrate on projects with the best chance of being implemented. Nevertheless, results are highly encouraging: 10 percent savings with attractive paybacks.

Feedback from the program has been very positive from clients in all sectors, particularly those who simply do not have the skills, time or resources to carry out these studies on their own.

Implementation, of course, is the key objective. From follow-up visits it was initially estimated that 41 per cent of the opportunities identified would be implemented: they were either under way, planned, or proceeding to feasibility studies. However, the recession has since caused many companies to drastically lower their payback thresholds, some to as little as 6 months, and the implementation rate fell to about 30 per cent.

4. Industrial Retrofit Grant Program

To combat this, last year the Ministry introduced an industrial retrofit grant program. Fiscal resources being limited, a three-year program was introduced, specifically designed to raise uptake and help companies during the recession to implement non-electrical projects that would otherwise not be done. The criteria allows assistance to bring payback periods down to as low as 1.5 years, with grants up to 30 per cent of the project cost, to a maximum of $300,000 per site except for wood energy projects which have double that limit.

To date, some 70 projects have been approved, demand has been high – not surprisingly – and companies have received capital assistance to replace inefficient equipment with cost savings totalling over $2 million. They are achieving savings not just in energy but in maintenance costs, production flexibility, environmental improvements, and even landfill costs in one case of a new boiler installed to use wood waste.

5. EnerSearch Program

We're also helping with projects to support new technical development. Our EnerSearch program provides support for long-term research and development, and two other programs assist first demonstrations of promising new technologies and up to five market-entry demonstrations for new efficient products.

6. Minimizing Rate Hikes

Holding down electricity cost is the most significant challenge for many firms today. As the costs of new electricity supply facilities are incorporated into the rate base, Ontario's historical advantage in electricity costs over our U.S. competitors is being reduced. To meet this challenge, Ontario Hydro is determined to keep rate increases as low as possible, and is taking major steps in cost control and improved productivity. Examples include renegotiating coal contracts, cancelling expensive uranium contracts, freezing salaries and reaching agreement on moderate wage settlements. Non-utility generation projects are being renegotiated and scaled back, in recognition of reduced need and the high impact on rates of proceeding with all the proposed projects.

But the principal means of helping companies deal with electricity costs are the conservation programs offered by Ontario Hydro. With its expanded mandate and funding for demand management, last year Hydro announced an increase in its demand management target to 5,200 Megawatts by the year 2000, and will invest some $6 billion dollars over the decade to achieve it. The target is equivalent to one-sixth of the forecast peak demand.

These ambitious goals will be met through a combination of financial assistance, information, rate incentives, standards and regulation, and fuel substitution. Programs are in place and being developed on a massive scale. For industry, Hydro is providing advice through audits and feasibility assistance, technology-specific incentives such as high-efficiency motors and lighting, and comprehensive financial assistance programs under the accelerated paybacks and business finance plans.

And Hydro's results are very promising: reductions last year despite the recession totalled 250 Megawatts of saved and shifted load. That's enough to supply the daily power needs of a city of 120,000. Industrial customers installed over half the total load reductions, with successes in many areas. High-efficiency motors, for example, contributed almost 5 megawatts of savings and market share rose to 22 per cent of motor sales. Efficient industrial lighting saved almost 14 megawatts. These programs are winning widespread support,

helping industries when they need it, and providing energy services more cost-effectively than new expensive generation.

8. 'Green Industry' Strategy

Finally, let me mention one more government priority. A competitive economy is also one that adjusts to supplying the products that we will want in the future. Ontario is developing a Green Industry strategy, which aims to make us a leading producer and exporter of products and services for energy efficiency and environmental improvement. With utility and government programs pumping millions of dollars into incentives to purchase these products, we want to capture the industrial development opportunities to produce them.

An example is the investment by General Electric Canada to manufacture new lighting products, halogen bulbs and T-8 fluorescent lamps, for the Canadian and export markets. This $144 million project is the largest-ever single investment the company has made in Canada. We're actively pursuing other opportunities.

9. Conclusion

In conclusion, energy has a major role in ensuring a competitive future for the Ontario economy. On the supply side, our New Directions will avoid the risks and costs of mega-projects. On the demand side we're proving up and going after the greatest potential: for improving energy efficiency, reducing costs, and providing the products for a green tomorrow.

Stan Hatcher: Thank you, Duncan. Our next speaker is Leo Flaman, who is Vice-President and Senior Consultant in the Power Division of Monenco, Inc., based in Alberta. He has 30 years of experience in gas, oil and coal fired conventional and nuclear thermal power plant projects, and in combined cycle, cogeneration and alternative energy industrial utility power projects. Mr. Flaman is a member of the Project Management Institute, American Society of Mechanical Engineers, The Association of Energy Engineers (Certified Cogeneration Professional), Canadian Institute of Energy, and the American Nuclear Society.

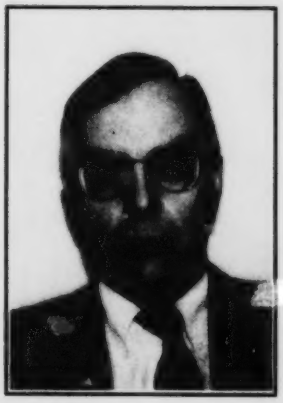
Please welcome Leo Flaman.

Energy Efficient Technology/Supply Side Management

1. Introduction

Competitiveness has always been linked to efficiency.

If a producing operation is efficient, the ratio of output to input is high. This is true of Manufacturing Industries, Service Industries and for the Electric Utility Industry in particular. The achievement of greater electric power production efficiency will benefit the producer, the Electric Utility, in that it can then offer electricity at a rate competitive with other available sources of energy. A competitive electric power purchase rate will assist the Utility's customers, particularly Industrial Consumers, in achieving their own competitive cost of production. Competitive production costs will contribute to the competitiveness of these Industrial producers, the competitiveness of their community, province and country.



Few new central utility generating plants are being built at this time in North America. Therefore, I would like to direct my remarks to the power production efficiency improvement in existing power plants using current electric energy generation technology - electric power generation from coal.

2. Supply Side Management Program

Popular terminology for efficiency-improvement programs, outlined hereafter, is demand-side management. However, I shall refer to them as a supply-side management programs. I have adopted the term supply-side management since the focus is towards existing generating plants and the possibilities of saving energy within these plants as opposed to demand-side management, which is aimed at the reduction of customer electric power demand.

2.1. Program Objectives

One of Monenco's major clients, TransAlta Utilities Corporation, has embarked on a Supply Side Management Program. Within that program, TransAlta has established two specific electric power generation improvement objectives:

- a 10% reduction in plant net heat rate, and
- a 10% reduction in the auxiliary power used to operate the plant.

TransAlta operates three coal fired power generating plants located 65 kms west of Edmonton, Alberta; Wabamun, Sundance and Keephills.

Taking TransAlta's Sundance plant (2200 MW) as an example, this means a reduction of plant net heat rate from 9900 BTU/kW·h at 34% efficiency to 8900 BTU/kW·h at 38% efficiency and a 13 MW reduction in auxiliary power from 132 MW to 119 MW.

To put these heat rates into perspective, the net heat rates for other generation technologies are approximately in Table 1.

Table 1: Comparison of Heat Rates by Technology

Technology	Heat Rate, BTU/kW·h	Efficiency, %
Combined Cycle	7500	45
IGCC	8500	40
Supercritical	8200	42

2.2. An Approach: Encourage Employee Suggestions

Efficiency improvement has always been actively pursued by Electric Utilities and within most electric power generating plants. Improvements in plant operation and the maintenance of plant efficiency have always been sought. The emerging global market place, however, has made it vitally important that an innovative approach be adopted for the determination of areas for potential efficiency increases and the improvement of our global competitiveness.

The method being used by TransAlta and Monenco to initiate this work is to tap the wealth of latent ideas that are available at each of the coal-fired generating plants of Wabamun, Sundance and Keephills. Brainstorming sessions are held at each plant with participants drawn from all areas of the plant. The objective is to record as many as possible of the plant staff's ideas that may contribute toward meeting the Supply Side Management objectives of:

- a 10% reduction in plant heat rate and
- a 10% reduction in auxiliary power.

It is recognized that these improvements are ambitious goals and therefore all areas of the plant are scrutinized.

The 'Ideas Lists' are prioritized to determine which ideas should be evaluated from an engineering and economic standpoint to determine which should proceed. The method used is to subjectively rate idea benefits from 0-10 and the technical feasibility of ideas from 0-10. These are plotted onto a chart, shown in **Figure 1**, which is divided into quadrants. Proposals falling into Quadrant 1 are 'Questionable,' Quadrant 2 is 'Don't Do It,' Quadrant 4 is 'Marginal' while Quadrant 3 is 'Go for a Detailed Evaluation.'

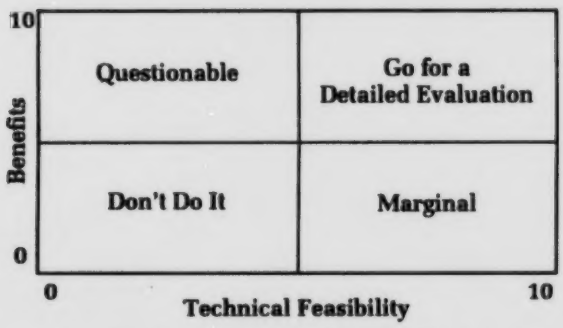


Figure 1: Proposal Evaluation Chart

3. Economic Evaluation

If, in the economic evaluation, the process of making more kW available is considered in the same manner as would a new power generating facility, any modifications to save energy and increase production efficiency are compared to current available replacement energy costs.

New power generating facilities can range from that of the recent Genesse coal-fired generating plant addition in Alberta, which cost in the region of $2000/kW, down to combined cycle and co-generation plants with capital costs as low as $800 per kW. This is the plant cost range that is brought into the evaluation.

To date, the societal cost of emissions such as NO_x, SO_x and other environmental externalities have not been directly considered or included in the evaluations. Efficiency improvements, by TransAlta will, however, result in less coal being burnt and therefore result in a reduction of such emissions and societal costs.

As an aside, and as an answer to the question directed to the previous panel regarding of the use of artificial intelligence in the industry, currently Monenco is developing an innovative on-line expert system to guide plant operations for TransAlta in order to reduce NO_x emissions. The system, named 'NO_x Smart,' provides the operator with recommended actions to minimize NO_x by proposing boiler operation optimizing actions. These actions in turn should result in improved boiler efficiency and therefore reduced operating costs.

4. Program Benefits

The aim of the Supply Side Management Program is to maximize the production potential of existing plants by the efficient utilization of the available energy. The resulting benefit is improved electric power production efficiency that leads to increased competitiveness.

The incentives for this type of program, as noted earlier, are reduced costs of production and having more energy (kW·h) to sell for the same amount of coal burned. There are other benefits such as:

(1) the delay of future new plant construction,
(2) reduced coal consumption; it is an abundant but non-renewable resource and
(3) the reduction of CO_2 (greenhouse gas) emissions.

5. Spin-off Benefits

A portion of the heat-rate improvement can be achieved through improved boiler performance. With an improvement of boiler performance, a number of spin-off benefits will be achieved.

An improvement in boiler efficiency reduces the amount of coal required to produce full load output which in turn reduces the boiler air flow, which reduces FD and ID fan power which reduces plant auxiliary power and allows more kW·h for sale and more revenue for the Utility.

6. Status

The program is in its initial stage. Several areas have already been identified for detailed evaluation:

- reduction in boiler back-end exit temperature to

improve efficiency,
- reduction in boiler air in-leakage and air heater leakage,
- reduction in boiler excess air with improved burner control and balance,
- use of variable speed drives for large fans and pumps,
- use of an existing gas turbine to assist in coal drying,
- more efficient utilization of all lighting, and
- the determination of current base line unit efficiencies to identify the areas with the greatest opportunity for efficiency improvements.

7. Conclusion

The TransAlta Supply Side Management Program, as presented above, will bring TransAlta closer to achieving their electric power generating efficiency improvement objectives of:
- a 10% reduction in plant heat rate and
- a 10% reduction in the auxiliary power.

The achievement of greater electric power production efficiency will allow TransAlta to offer electricity to their customers at rates competitive as possible with other sources of energy. A competitive electricity purchase rate will assist TransAlta's customers in attaining competitive costs of production. Competitive production costs will contribute to the competitiveness of Alberta Industry, and the competitiveness of Canada.

Stan Hatcher: Thank you very much, Leo.

Our third speaker is Mr. Carl Beigie, who is Chairman of the Board of the Canadian Foundation for Economic Education.

In recent years he has also been Chief Economist for McLean McCarthy Inc. in Toronto, Adjunct Professor of Business Economics and Academic Director of the Executive MBA program in the Faculty of Management at the University of Toronto, and a Director of the Ontario Housing Corporation. Mr. Beigie was the founding Executive Director and later President of the C.D. Howe Institute. He has taught at the University of Western Ontario and McGill University, and has worked for the Irving Trust Co. in New York and Dominion Securities in Toronto. Mr. Beigie's articles have won a National Business Writing Award and the Adolph G. Abramson Award of the National Association of Business Economics. Carl has traditionally taken the broad view and I think his presentation to us this afternoon will certainly clarify our position in the global economy.

International Trade and Competitiveness

1. Economic Illiteracy

Mr. Chairman, thank you very much. I appreciate the opportunity to be with you today. I note the fact that the Chairman said all those "has been" things, which is really what I'm concentrating on being these days, a 'has been,' for a very simple reason.

One of the things that disturbs me very much about this Canada of ours, is that while worry about language illiteracy, we, as a nation, and I mean this with no malice, but I have concluded very firmly is that Canada is a country that is economically illiterate and most especially public-policy illiterate.

It is also a fitting description of our Federal Government, which looks to the Department of Finance for virtually all of the wisdom that's going to come out of Ottawa on economic policy-making. They recently killed the one thing that I and my economics colleagues in the private sector have long counted on: namely, the Economic Council of Canada. After all, that's 10 million dollars a year, and we couldn't possibly need to spend that economics, could we?

Competitiveness is a term that is used with increasing frequency; we all know about it, but it has not generally been thought through very well in this country. Mr. Wilson and his 'Prosperity Initiative', in my judgment, is a sign that Ottawa doesn't know which end is up in terms of competitiveness.

They paid a 1.4 million dollars for Michael Porter to come up from Harvard and tell us what it's all about. Those of you who have tried to read Michael Porter's analysis, as I have a number of times without much success, would be impressed by the fact that it's the kind of writing that once you put it down, you find it impossible to pick up. My whole notion of economics from the time I first got into the profession is that if it's not put in communicable language, we aren't going to get anybody to do anything useful in this general area as a consequence.

2. Canada's Competitiveness

I've studied the international trade and competitiveness issue virtually throughout my entire professional life in economics. I have concluded, as many other people who have looked at this seriously, that there are a very large number of issues that influence the competitiveness of countries, industries and individuals. For example, I'm not competitive with Michael Jordan in terms of playing basketball. I'm not tall enough, among other things.

But I want to talk about the competitiveness of industries, the competitiveness of regions and even the competitiveness of nations. What I want to start with this afternoon with you is to discuss the broadest level of competitiveness; that of a country, or actually more formally the competitive-

ness of a currency area, because that's what Canada remains. And even if Quebec goes, it wants to be part of our currency area, according to Mr. Parizeau. In any event, if we start at this broadest level, what you come down to is that competitiveness is a function of three dominant considerations.

The first, and in my judgment as an economist, the most important of the three is the level of efficiency or productivity that is achieved. Second, also highly important, is the payments demanded, and actually more properly those actually received by factors in the production process. Now, that's just a weasel way of saying essentially labour and management; what they want in terms of wages and salaries. And the third consideration, of fundamental importance at a national level in terms of determining competitiveness, is the relative value of the currency. That's of basic and fundamental significance.

Throughout much of its history, Canada has not really thought very systematically about a competitiveness strategy. A large verdant land mass next to the political, economic and military power of the United States and with really a quite limited population base, Canada has enjoyed an abundance of tactical options and really did not need much strategic thinking. If we wanted more, well, we trapped more furs, we cut more trees, we dug more mines, we drilled for more oil wells. If the people demanded too much, our currency depreciated. And in the early 1970s, for a brief period, our currency even appreciated, to the point of being at a temporary premium relative to the U.S. dollar.

When things for Canada became really tough we could always count on a fairly gentle United States. I say that today a bit tongue-in-cheek, but I'll come back to that; they generally didn't mind giving our key industries, that they generally owned, a productivity boost. A prime example of that was achieved in 1965 with the automotive agreement, something that I never hear discussed here in the West because they don't have many automobile assembly plants west of Toronto.

3. Replacement of the National Policy of 1879

Looking back, Canada adopted a national policy in 1879. I keep asking my students about this and they don't even know what the hell I'm talking about; which I suppose reflects on the weakness of Canadian history courses these days. In any event, the national policy was adopted in 1879; it was exploited with considerable success until the mid-60s. And as I like to recall for people I speak to, in 1879, we had what economists called an 'infant industry,' as an argument for our protective trade policy. In the 60s, nearly 100 years had passed and we were still dealing with infant industry types of logic; that's a Canadian approach to competitiveness. What we had in this country was a geriatrics policy, not an economics policy. We economists giggle about that once in a while, but it's sadly true.

One of the things that Ontario is going through today is dealing with the problem of getting a geriatric manufacturing sector up to snuff in an increasingly tense and tough international world. Following what I regard as the disastrous energy policy of 1980, it was clear we needed something else to replace John A. MacDonald's 1879 National Policy.

A potential replacement was discussed in the early 1980s called the 'Mega-project Strategy'. It had promise because of its diversity, both in terms of commodities that would be included, and in terms of the regions. Everybody had a potential mega-project. But it failed because of the very high costs of financing in those years, the emergence of new sources of substitute supplies and technologies, and most of all because this country has so much difficulty acting or even thinking nationally. Finally, when we came right to the core, Canada had no choice but to act and it did so with the Free Trade Agreement (FTA) with the United States.

Eventually, the FTA is going to force Canadian competitiveness to rise, as did the 1965 Automotive Agreement. And it's going to increase Canadian productivity in a very significant way. This will, over time, improve the nation's competitiveness through rising productivity. We can play games politically with FTA, but as an economist there's not the slightest doubt in my mind that the FTA has brought Canada the most significant potential gain to its competitiveness than any single act this country has ever undertaken.

Almost simultaneously, however, another major policy shift was made, this time by the Bank of Canada. Instead of seeking to continue its policy of the post Second World War period of trying to do no worse on inflation than did our major trading partner, namely the United States; Canada is being forced by the Bank of Canada to pursue an absolute inflation goal of nearly zero.

This monetary policy shift also places great pressure to improve competitiveness from increased productivity and moderation in nominal factor payment. (That's wage and salary demands of workers and managers). Slowness in achieving these objectives, and for sometime we've had difficulty achieving either one, slowness in achieving either boosts unemployment and adds a further structural dimension in Canada to the cyclical downturn that is taking place on a global basis at the present time.

Now, let's not kid ourselves, this is a really hard ball competitiveness strategy. Given the massive national debt this country has allowed itself to accumulate from 1975 onward, I can think of no clearly better alternative. I've had my bouts of 'Crow' bashing, as almost every economist I know has, but I know of no clearly superior alternative to the mess that this country's national economy is in at the present time.

4. The Free Trade Agreement

I do have serious reservations about one fallout from the Free Trade Agreement, which is that it appears to me we have abrogated, and I use that term advisedly, abrogated our trade policy independence to the United States. Participation in an Americas block, set against the Tokyo-dominated Asian block and the German-dominated European block is not in this country's best interests, as I see it, because it essentially says that we are becoming just another spoke to the United States' hub.

It most especially, in my judgment, is not in the best interests of the Western provinces, which are represented here today, which looks increasingly to the Pacific Rim for their trade expansion. And the movement to the Mexican/American/Canada Free Trade Agreement is too much of a central Canada preoccupation with the Americans. In short, and I've thought about this very seriously, I believe Canada should consider quite carefully saying thanks but no thanks to the current NAFTA proposal.

5. A Possible National Energy Policy for 1992

But we better have an alternative. We better think hard about an alternative. And the one that comes to me, which I think is in the Canadian national interest, our national interest, would be to take five years to gear up to achieving the maximum possible benefits that are possible under the FTA with the United States. Then, starting, say in 1998, Canada should begin a gradual five-year elimination of our tariffs on all imports.

Ninety per cent of Ontario's trade is with the United States, 75 per cent of all of Canada's trade is with the United States. We should not unilaterally bind, if you know what that means in GATT lingo; it means you can't raise them again once you've bound your tariffs. We should not bind these zero tariffs, but we should be prepared to do so on a case-by-case *quid pro quo* basis that would say to the world that we've learned about the potential advantages from free trade, we're going all the way.

And by the way, folks, we may have to go to a 70 cent dollar, in terms of U.S. currency, or even less, as we go through the transition period. But it would be a far better way of doing things than what we're doing right now. Trade policy, which is really the subject of my remarks, to my mind, should be the means. The means, and I emphasize this, because I just don't see that Mr. Mulroney and the conservative government in Ottawa understand this, should be a means for a national competitiveness policy not the end of such a policy. Means and ends indicate something different to people who try to be careful with language.

Canada needs a new national economic policy and can no longer stay in the exclusive realm of dreams. For this country has to come up with a modern variant of the national policy of a century ago. A successful strategic initiative in my judgment is simple; we must seek to excel in the effective use of what we have. It's that simple. Excel in the effective use of what we have.

As a nation, we have spent far too much valuable time debating what I regard as secondary issues; who owns us, who is the guy producing the production? Again, I have thought lots about this. I would propose that the nation must refocus on the services that are available to all who wish to locate here; those who are here and those who want to come here. No nation in the world has the capacity to offer more than the Canadian nation does.

A new national policy strategy for Canada would be composed of these parts; and I only offer seven. First, optimization of our arable land and fresh water, which is in my judgment an inherently planning type of activity. Second, maximizing the value added to our non-renewal resources prior to exporting them. Third, securing energy availability at prices, at or below world levels. Fourth, being at or even setting the world frontiers in transporting goods, services and people. Fifth, being a world player in telecommunications. Telecommunicating and telecommunications will constitute the railways of the late 20th and early 21st centuries. When you give things, you always think of yourself, and in my sixth, I think of myself and everybody else in this room, confronting the aging process. One of the things this country has, and we better start using them more efficiently, is people growing older. And seventh, and I just can't believe how little serious attention we have yet given to it, is seeking the continuous enhancement of everyone's skills. We do not get to a point when, as we leave a particular age, we can say that we're done with education. Society will demand that we upgrade our skills as we go along.

6. Conclusion

Well, let me conclude simply by saying that to me the ultimate objective of any dynamic society should be to achieve, on a sustainable basis, improvements in real per capita well-being. It's got to be sustainable. The only group I never hear discussed any more by the body politic in this country is one group that hasn't got a vote, and those are the people who haven't been born yet. I, for one, do not want to die saying that what I've left my progeny is going to be significantly less than I was given when I was born.

How to achieve this objective ultimately is the responsibility of individual nations acting within internationally agreed frameworks. The United States will not answer the questions that Canada must answer itself.

Thank you very much.

Stan Hatcher: Thank you very much, Carl. We can always count on you for a stimulating and provoca-

tive talk, and I'm glad to see that the provocative issues have come from both the floor and from the panel itself.

Now, I have some questions here, I'm sure there'll be a lot more coming in, but let me start with one of several addressed to Duncan, and I think some of them are related, so I will try to sort these out a little. Let me start off with this one: "What needs to be done to achieve a longer view or horizon on industry's payback requirements?"

Duncan Taylor: The answer that we came up within our Ministry is very straight-forward. We recognize that without further financial assistance, industry would not be making those investments.

However, there were additional things discovered after the first round of the audit program, which have also been put into place. We found, for example, that it wasn't sufficient just to do an audit and tell people, "Here's your report, go to it." You need to follow up. Follow-up visits have proved to be very important. Presentations to senior management have been important, and following the initial potential studies, the demand has grown significantly for more detailed feasibility analysis. We expect that some of that low uptake that I referred to will be significantly raised when feasibility analyses are completed. All of those things, I think, can contribute.

But my main point is that in the current economic climate you simply would not see a higher uptake without some financial assistance.

Stan Hatcher: Thank you, Duncan. There are two more here which are closely related, but I'll read them one at a time so that you can remember what the questions are. The first one is: "The grants for funding power studies, are these for engineering studies or for final improvements?" And the second question is, "Briefly, what are the payback details?"

Duncan Taylor: The grants to which I referred are for final improvements, retrofit grants. Those grants have a maximum limit of $300,000 for any one site, with a higher limit allowed for wood waste projects. These grants are able to bring paybacks down to as low as one and a half years, but not necessarily, with a maximum, I think, of 30 per cent of project costs. There are also partial grants, given for the two other areas I mentioned. For a feasibility analysis, we would pay up to 75 per cent of the cost and for detailed project engineering, we would pay up to 25 per cent, both with a maximum of $70,000. These are three grant programs we offer.

Stan Hatcher: Duncan, this one is also on the audits and grants, and reads, "Grants for audits and engineering studies are understandable incentives from government. Please comment on why it's necessary to give grants rather than soft loans or other incentives to industry to persuade industry to actually implement energy efficiency projects".

Duncan Taylor: Grants are used instead of loans because the former are easier to administer than the latter, and so require less overhead. Better customer service is achieved with grants than with loans, because the turnaround time is faster. In addition, companies we interviewed about the reasons they were slow in implementing the recommendations of our audits indicated that they were suffering from serious cash shortages, which could best be addressed using straight grants.

Cost-sharing grants to encourage installation of commercially-available technologies ranged from 20% to 40% in the jurisdictions which we surveyed.

Our analysis indicated that a grant level of about 30% would be required to lever industry into action.

Stan Hatcher: The next one is for Leo. It says: "You've mentioned the use of current average electric price as the economic test for investments. Would it not be better to use TransAlta's avoided costs or long-range incremental costs?"

Leo Flaman: TransAlta is currently preparing a Request for a Proposal (RFP) for 100 to 200 megawatts of electric power production, and in that RFP they will be stating their avoided costs, and I expect it to be somewhere in the vicinity of about three cents per kW·h.

Stan Hatcher: I think we will put Carl on the stand for a moment: "What comments do you have on Canada's low investment rates in R&D?" There's another one, I think, from the same person: "Discount rates and payback periods are drivers which determine investment decisions. Do we not undervalue the future and the environment in our choice of these critical parameters?" I think we've got two separate questions here, Carl.

Carl Beigie: Yes. The answer to the second one is yes, we do undervalue the future by looking for short paybacks. I just cannot believe so many decisions in which I've been privy to have been made using such incredibly short time spans. We can go on about that, but it's a problem.

About R&D and low investment, we've got a serious problem in this country because most Canadians think they're relatively abundant savers. The biggest problem we have is that we compare ourselves with sluggards in terms of saving, namely the United States. And we don't do badly compared to them, but compared to anybody who counts in terms of the international competitiveness game, we're not doing overly well especially when we take into account the dis-saving, which is really what government debt and deficits represent. You know, one of the simple realities, and I kind of bled a little bit for one of the speakers this

morning talking about how are you ever going to convince the Canadian public that they shouldn't have more. Well, we can have more temporarily, but what we're going to be left with is the pits, frankly, in terms of our performance over the long term.

In terms of R&D, in terms of investment generally, I have a very simple rule that I teach. Look, if we are going to improve our growth, which is really the ultimate objective of R&D, then we're going too have to increase our productivity. But if we want to increase our well-being on our own, instead of buying more and more capital from other nations whoare prepared to help bail us out of our deficits, if we want to increase our well-being out of this higher productivity, we're going to have to save more and spend less. Now, that's not fun. That's what all right-wing guys all preach about.

I'm not right-wing, but I basically feel that we're going to have to focus a lot on this. If we, as a nation, were really serious about investment – I'm not a big fan of a country of Canada's size trying to do everything that every other country of the world does, but on the cheap. I've actually had long debates with our Prime Minister, before he became Prime Minister, and he was doing his conventional waving of the arms thing about when he was in government he was going to raise the share of Canadian GDP going to raise R&D expenditures to twice what they were, to two and a half per cent. And I said, 'Why?' And essentially what he was saying is that we were going to spread the R&D funding thinly over everything. My attitude is that this is just plain wrong. We should copy the Japanese. Import one of everything, figure out how you can make it cheaper, where you can do it more efficiently and develop the thing. You know, let somebody else's bright boys do the 'R;' we'll do the 'D.' The 'D' is where the real growth is going to be.

But there are other places to put your funds for investment purposes. One, like it or not, is into plant and equipment. Another is infrastructure. Now, I have a son in Rochester, New York that I drive down from Toronto to see periodically, and nowadays I'm scared to cross upper New York State bridges and drive along their highway system off the turnpikes, because they just don't seem to give a damn about maintaining their infrastructure any more. I think that's really dumb.

Most important, and I use this phrase quite commonly, I can remember my first lesson in economics was to watch my dad go to work with his capital stock. He was a tradesman and he carried his tools in a kit. When I go to work, when you go to work, we carry our capital stock between our ears. And what we're doing in terms of improving what goes between our ears is atrocious. And what we're going to have to do is to raise the capital that we're carrying around in our heads if we've going to be prepared for the 21st century. So, that's where I would put the emphasis in terms of investment activity: into education.

Stan Hatcher: Thank you, Carl. I'll go back to Duncan again: "Under the Ontario Minister of Energy's 'EnerSearch' Program, a 100-kilowatt grid-interconnected photovoltaic project will be financially supported. How can this be a cost-effective use of public dollars? What will be learned and what industry will benefit?

Duncan Taylor: That's not a project I'm familiar with. But I imagine that we are attempting to develop a photovoltaic supply capability in Ontario. Photovoltaics is a technology where there is a great deal of international work. I don't think this project would be a very large one in an international context. Again, I can get back to the questioner on what we expect to learn, but I think this is a niche activity in the Ontario context.

Question from the Audience: Thank you, Mr. Chairman, my question was too long to write out. It's addressed to Mr. Flaman and perhaps something for Dr. Taylor. It's my understanding, Mr. Flaman, that TransAlta Utilities accounts for their demand side investments by expensing them in the year in which they're made. That's quite different to what both B.C. Hydro does, and what we do in our little utility, we amortize them over a period of time. How does TransAlta propose to account for the supply side management investments that they're going to make? And if it's different from what I've described as what they'll do with the DSM one, how does Harry Schaffer account for the difference? And the other end of the question, perhaps Mr. Taylor might comment on how the investments in demand side management by Ontario Hydro are treated on an accounting basis. And perhaps Mr. Beigie might arbitrate the appropriateness of either principle.

Leo Flaman: I am not familiar with how TransAlta will handle supply side management, but I believe that these projects will be considered as capital projects and will, once completed, then be included into the rate base, and recovered over time.

Duncan Taylor: As far as I'm aware, the investments made by Ontario Hydro in demand management, if one looks at last year's programs, which as I mentioned are reported to have saved 250 megawatts of customer load, amounted to some 180 million dollars. Approximately half of that was capitalized, that is the incentive payments to customers on the logic that those are payments on savings which will be achieved over a long time-span. I believe a 10-year accounting period is used to recover costs. For the component of expenditures and demand management, which reflects operations and ongoing administration, those are expensed in the year that they occur, to my understanding. I don't know if that answers your question. It is acknowledged that in the short-term, demand management expenditures will have some upward impact on the rates paid in order to achieve the broader objectives of lower overall energy service costs.

Getting back to the points that were raised this morning, lower cost of energy services is the fundamental justification for demand management.

Carl Beigie: I don't want to disagree on this, but over the last couple of years, one of the things I have spent a fair amount of time on is Ontario Hydro's positioning. And while I respect, and have said so publicly, their efforts to reduce demand, I feel rather strongly that if I were in a heavy energy-using industry in Ontario, I'd be more than a little bit fearful that the demand restraint would not take place, ergo that demand and supply will always be brought in balance. No question about that. The price will do it.

We put a lot of emphasis on this back in my old C.D. Howe days, that if you're going to do something like this, which is somewhat higher risk than I think anyone in the Ontario Government yet fully understands, you should have a clearly thought-through policy which is well-articulated with big Hydro energy users in Ontario; tell them what your contingency plans are, in case you don't actually cut the mustard in terms of demand management and restraint, for what that's worth.

Duncan Taylor: Perhaps I could address it? The updates to its demand supply plan that Ontario Hydro put forward at the start of this year did stress the ability, in their view, to provide that assurance that heavy electricity users are seeking, the assurance that there is reliable supply. That was a cornerstone prior to that of the Government's new energy directions.

And some of the evidence that Hydro brought forward was the evidence that non-utility generation, often gas-fired co-generation, was coming forward in spades, coming forward in greater amounts than they needed, given the current downturn in demand. So they have been renegotiating and scaling back the short- term planned projects. So, based on that evidence, I don't think that industry need have any fears that there isn't a backup reserve, with the ability to bring it on in fairly short time frames compared to those of nuclear plants.

Stan Hatcher: I've got quite a few more here for Carl Beigie, and we'll try and pick a couple before we have to close off here. This one is: "They don't publish Canada's world ranking for standard of living any more. What is it? Please comment on how it could be improved."

Carl Beigie: Is that true? I keep hearing the Prime Minister say, "We're number one, we're number one. Trust me, we're number one." One of the problems I have with that whole ranking is that it's out of date by the time it comes out. That's the trouble I have with these surveys that rank Canada above everybody in 'quality of life.' They ought to go back and look where we are today, and we're not number one, I would suspect, in terms of economic performance. Far from it.

Let me take one second to throw out something that really has me concerned about the Free Trade Agreement, Canada, and the reason I am a Canadian. I am one of the few people I've ever met in this country who actually chose to be a Canadian, and purposely gave up U.S. citizenship. Now, I don't feel negative about the United States, but I just found coming to Canada that this is the nation that I believe in. You know, this is where I want to be. For a simple reason: historically, this is a much more what I might term a 'communitarian' nation, exemplified perhaps by Pierre Trudeau; whereas the United States might be exemplified by Ronald Reagan. I don't know what Mr. Bush stands for, but Ronald Reagan was very clear in his articulation that the individualistic market would solve everything.

This country will not be number one, I'll put it in the negative in response to the question, if it chooses somebody else to tell us what we're going to be like. Every time I get on the road to New York State to see my son and try to get back through the border line-ups on a Sunday night, and I find all other non- communitarians in the line-up who are unthinkingly prepared to give up anything to get cheaper goods in the United States, at a huge expense to the uniqueness of this country, I despair a bit.

But we face a very critical choice. And I make no bones about the fact that I spent the first 10 years of my time in Canada in Montreal. I, contrary to virtually anybody I've met in Western Canada, I feel that Montreal and Quebec generally are very important to the future of this country as a country. I feel very strongly about that.

The difficulty, and it's fundamentally difficult to me, is that the market mechanism that's reflected in Ronald Reagan, Maggie Thatcher, and to a degree, to the extent that he understands it, Brian Mulroney, is incompatible with the French fact. And if I were a Quebecer, I would be worried about the future of my culture, if the approach of the 'market uber all-ists' that we have seen in this rightward shift is carried too far.

And so the answer to the question, I'd go back and re-establish what this country is all about. But that means that we're really going to have to as individuals put up with the fact that we're not going to be able to afford the massive amount of subsidization of the better-to-do in terms of their tuition costs for their children, in terms of the health costs, when they refuse to pay their share of the costs they've incurred; there's got to be user fees; I'm sorry, and a lot of people don't like that.

So in my judgment, we have to go back and reassess what we are. And if we don't do that soon then all we're going to be is the North American vacation spot, that's what we'll be. And hell, here in Victoria this is a great vacation spot, but Canada should be more than that, and historically it has been more than that. And its

ability to reconcile this reality. We can't saw ourselves off from the rest of North America and go floating off into the Arctic, because it's too bloody cold there for one thing. We've got to re-establish the fact that we are different than the Americans. Not better or worse, but we're different, and damn it, we like it. I'm just afraid there are not enough of us that seem to still like it!

Phil Larstone: Just one real short and quick question. It's in response to what Carl Beigie said about user fees for health costs. And previously he said we should take care and look after our elderly and ageing. Who should pay for the increasing costs of looking after elderly patients?

Carl Beigie: We should. We can afford it if we want to afford it. But its not going to get any easier to balance the books on health care.

Phil Larstone: Why do we not expect the corporations to pay their way? But they are allowed to defer their taxes forever it seems, and then they get them written off. But shouldn't there be a user pay there also?

Carl Beigie: One of the things I learned in fiscal policy very early on is that it's always you and me that pay for the corporate taxes. If you tax corporations more, they're going to turn around and raise their prices enough to recover their tax costs. So, I'm just being a fatalist about this, I guess.

Stan Hatcher: Thank you very much to the panellists and to the members of the audience. There are quite a few more questions for all of our speakers here, but we really have run out of time and it just is up to me now to just draw this session to a close.

I think we've had a very good and spirited discussion this afternoon, ranging all the way from defining and trying to analyze what energy efficiency and competitiveness are all about; looking at some potential for improving our effectiveness and our competitiveness; looking at two sides of government activity from regulation to stimulation.

I think we've had a very good session this afternoon on our position in international competitiveness. And I think, drawing on one of Carl's final statements, that the real bottom line is sustainable improvement and real individual well-being, I think.

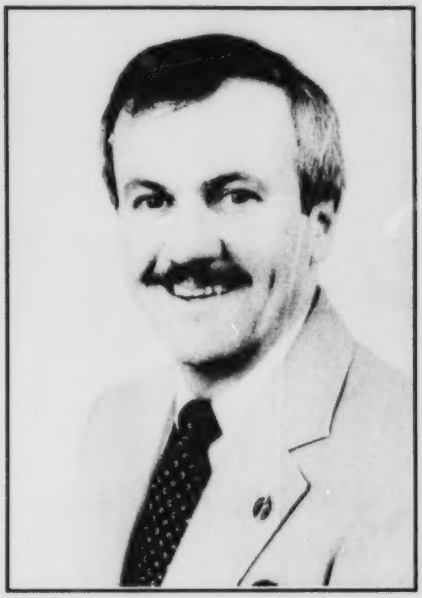
The energy industry historically has helped to provide that; it's replaced the thousands and thousands of slaves that we used to have centuries ago with machines that do make our lifestyle better and our individual well being better. Clearly, we still have a long way to go. And I think this panel this afternoon has addressed some of the questions that we have to tackle in getting there.

On your behalf, let me thank our second batch of panellists this afternoon, and also a thank you to you for your spirited discussion and your lively questions. Thank you, panel.

Banquet Address
Federal Response to the Issues of Competitiveness and Sustainability

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.



The Honourable John MacDougall is the Progressive Conservative M.P. representing the Timiskaming riding in northern Ontario. In addition to his duties as Parliamentary Secretary to the Minister of Energy, Mines and Resources, Mr. MacDougall has served as Chair of the Committees of Election, Privileges, and Procedure, and Liaison; as the Ontario Member on the Legislative Committee studying the Canada-U.S. Free Trade Agreement; as Vice-Chair for the Standing Committees on Aboriginal Rights and Northern Development, and Environment and Forestry. Since his election, he has been an active member of the Energy, Mines and Resources Committee(s).

Banquet Address

Federal Response to the Issues of Competitiveness and Sustainability

The Honourable John MacDougall

Parliamentary Secretary to the Minister of Energy, Mines and Resources

Introduction of John MacDougall by Scotty Cameron

Good evening, ladies and gentlemen. My name is Scotty Cameron, I'm chairman of the Energy Council of Canada and it's my privilege and pleasure to welcome you on behalf of the other sponsors this evening.

I think most of you are aware that the Honourable Jake Epp, the Federal Minister of Energy Mines and Resources, is unable to be here this evening. He is in Ottawa, dealing with the Nova Scotia mine disaster. But we are fortunate to have in his place, the Honourable. John MacDougall, who is the parliamentary secretary to the Honourable Jake Epp.

However, John has to leave early in order to catch a plane back to Ottawa tonight, in order to be in parliament at 10 o'clock tomorrow morning. So there is a time restraint. We are going to ask Mr. MacDougall to make his presentation before we have our dinner and then we will complete the remaining formalities after our dinner.

So, ladies and gentlemen, would you please welcome Mr. John MacDougall.

Thank you, Scotty. Ladies and gentlemen, it is a pleasure for me to be here in beautiful British Columbia. When Minister Epp spoke to your Energy Council of Canada meeting in Halifax a while ago, he launched the Energy, Mines and Resources 'Green Plan' energy efficiency and alternative energy program with the announcement of new legislation. At the time, I believe your organization was a branch of the World Energy Council called CANWEC. Since then you have changed your name to Energy Council of Canada, and the Minister has announced more efficiency and more alternative energy initiatives.

Well, tonight, on behalf of Minister Epp, I am going to announce four more energy efficiency initiatives. I would like to think that these initiatives indicate that we are both adapting to increasing pace of change. Some of this change will come from our own initiatives, some will follow as people learn about the needs of wise energy use and some will stem from international meetings such as the United Nations Conference on the Environment and Development, better known as UNCED to be held in Rio next month.

Change is a reality in the world today but there is another need, a need for sustainable development which recognizes that economic development and environmental protection must go hand in hand for a vibrant future. We must meet our present needs without compromising the ability of future generations to meet their needs. The production and use of energy is a key factor in the formula for future sustainable development.

One of the methods is to start realizing that the future is through energy efficiency, and this is important for Canada because our economy is energy intensive. Energy efficiency has many spin-offs for us. It can help make us more competitive both at home and abroad. It can build the attitudes and behaviour that will help protect the environment in the long term. And the race is already on to develop competitive technologies and services in markets around the world.

The Government of Canada is committed to energy efficiency as a broad public policy, through taking actions that make economic sense in our economy. Our public information campaigns, corporate consultation and partnerships, buildings, research and development efforts, and regulations all reflect this. Efficient energy production, transmission and use help reduce pollution and emissions of greenhouse gases. Goods-producing industries consume 35 per cent of Canada's energy. Since the mid-70s this energy-intensive sector has made annual improvements of 1.5 per cent in energy efficiency through a voluntary commitment to energy efficiency targets which the industry set for themselves under the Canadian industrial program of energy conservation.

One example of success is the petroleum refining industry, which achieved an efficiency improvement of 35.8 per cent, surpassing their voluntary target of 30 per cent over the same period of time. However, future improvements in the use of energy are certainly possible and desirable to improve prospects for future prosperity. Energy efficiency is not a passing fad, not of making a quick buck, but for paybacks over the long term. There

is a lot of installed equipment out there that has many years of service left, so our progress will be limited by the speed at which we can replace existing machinery and technology.

The challenge is to do what we can to increase the pace of change without reducing production and our ability to compete. Recently, Energy, Mines and Resources (EMR) began introducing a series of 'Green Plan' initiatives through our efficiency and alternative energy program. These initiatives include the Energy Efficiency Act, which established standards and labels for energy-using equipment, measures to improve energy efficiency, standards for buildings and programs for alternative fuels.

In Halifax, the Minister told you about the work being done by CANMET, the Canada Centre for Mineral and Energy Technology. Under the auspices of the panel on Energy Research and Development, CANMET has been spending about 16 million a year in energy efficiency research and development.

But the government is not the only player. Canada's energy producers are playing a crucial role with their own efficiency programs. An excellent example is the aggressive demand-side management efforts that have been made by Canada's electric utilities, world leaders in energy efficiency. It is no surprise that utilities from around the world, from Czechoslovakia, Mexico, Thailand, are coming to Canada to learn how to be Power Smart.

It is in support of such efforts that I am pleased to announce today, on behalf of Minister Epp, four more EMR 'Green Plan' energy efficiency initiatives:

(1) The Minister's Advisory Council in Industrial Energy Efficiency,
(2) Enhanced support for Canada Industrial Program for Energy Conservation,
(3) A new targeted industrial research and development program, and
(4) A new corporate leadership initiative, entitled 'Energy Innovators' Ventures.'

The Innovators' Ventures office will work with Canadian corporations to identify energy efficiency and alternative energy opportunities, to develop and implement action plans, and to report on the collective impact of energy innovator actions to Canadians from coast to coast. But we can't do it alone. That is why the Energy Innovators' office is developing allied teams for energy efficient equipment manufacturing companies, energy management supply companies and utilities. Together, we will attract support for Energy Innovators to help ensure the successful implementation of the Energy Efficiency Act plans.

Nor do we want or expect Canadians to do more than what we as a Federal Government are doing. Prior to tonight's dinner, I had the pleasure of signing agreements with B.C. Hydro and Centra Gas to expand our Federal Buildings Initiatives (FBI) into British Columbia. Over the last few months, the FBI has changed the basic way the government manages its energy bills. Through the FBI, we have empowered our managers to adopt energy-saving technology and finance energy efficiency improvements.

I am proud to report that our department has led the way in implementing more than 2 million dollars of lighting improvements to reduce the energy used for lighting by more than 30 per cent. And this is just the beginning. To date, Federal departments have identified, and are pursuing, further investments exceeding 60 million dollars, all of which can be paid for through future energy savings. Together, through partnerships with allies and creative initiatives like Power Smart, FBI and Energy Innovators Ventures will actively address the critical national issues of energy efficiency, pollution prevention and national prosperity.

Partnerships are also key to the efforts in the industrial sector. That is why it is essential for the future of our industrial energy efficiency program that we will be establishing a Minister's Advisory Council. With representatives from all major energy-consuming sectors in Canada, the council will stimulate the development and implementation of private sector initiatives to address energy efficiency.

This initiative will provide opportunities for Canada's firms to lead and to influence public policy and energy efficiency. Given your willingness, we will combine our expertise and resources to create a team that can make a real difference. Participation is voluntary, but the potential rewards are great.

At the same time, we will enhance or support the Canadian industry program by promoting further gains in energy conservation. This industry task force will develop strategic plans for major Canadian industry sectors. Their plans will spell out energy efficiency targets, identify and develop support requirements such as training and technology development, and undertake economic analyses of energy efficiency opportunities.

To support our department's research and development arm, the Canada Centre for Mineral and Energy Technology, we will introduce a new industrial R&D target initiative. Under this program, CANMET will establish a consortium of groups from government, industry, utilities, research institutes and private sector organizations to share the overall costs of realizing the potential of the same or more promising concepts of energy efficiency.

We are certain that this new research and development program will keep industry on the cutting-edge of emerging technology. Such programs are essential, be-

cause despite impressive gains in energy efficiency in all sectors of the Canadian economy, Canada still remains a relatively high consumer of energy. Measured on a basis of either per capita or per unit of gross domestic product, Canada rates as one of the most energy-intensive countries in the world.

However, this does not mean that Canada is also one of the most energy inefficient countries in the world. A country can be energy intensive, and still be very energy efficient. There are several important reasons why Canada's economy is so energy intensive. Our climate is harsher than other countries and Canada has a relatively low population density, which requires higher energy use per capita to transport people and goods across the country.

Finally, many Canadian industries, such as aluminium and pulp and paper, are very energy intensive. Because our country is so energy intensive, energy efficiency must play an ever-increasing role in helping achieve a competitive edge in our competitive world. Environmental challenges and our growing need for energy efficiency will provide Canadian industries, particularly energy producers and energy-using product manufacturers, with additional economic and trade opportunities.

As you know, the Government of Canada policies are geared toward providing a level playing field for market forces. Centre to our approach is the development of partnerships between private sector, academic institutions and governments, to pool our resources, our knowledge and our energy to meet the challenge of increasing competitive global markets. And we are counting on the unified approach under the Energy Innovators' Ventures program to find solutions that will lead to practical applications and future prosperity for Canadian businesses. If we can produce goods and services and work to our maximum economic and environmental advantage across Canada, we can offer those products to foreign businesses and industries. This too can make a valuable contribution to our country as our overseas customers move towards a goal of sustainable development.

Some people have advocated that the government should adopt a 'command and control' approach to encourage development and application of energy efficient technology and practices. While these command and control measures may be effective in achieving a particular short-term objective, they would provide little incentive to firms to do better than the minimum requirement by government legislation. There is also a risk that such measures will lock in technology rather than encourage innovation that responds quickly to market demand.

We need a judicious mix of incentives and regulations to protect the environment and to stimulate technology advances and trade opportunities. However, we are also concerned that any regulatory or any policy measures do not put us out of step with a similar response by our major trading partners. This is especially true when we are talking about measures to address climate change which have potential effects on our industrial competitiveness. For this reason, I believe it is important for us to continue to move forward carefully and wisely, doing first the things that make economic sense in their own right so that we can maintain flexibility and achieve our objectives in a cost-effective manner.

This long-term planning lends itself well to the concept of sustainable development. Without energy, modern society could not exist. The fact is that the heart of the debate concerning sustainable development however is agreeing on how we can maintain progress without exhausting our resource base. I firmly believe that energy efficiency is the major key for progress towards sustainable development, and EMR's energy efficiency initiatives are designed to assist in achieving that goal. What we should all be reaching out for is the integration of environmental well-being and economics into the decision-making process. An increasing number of people demand more environmental protection through reduced pollution. Public policy bodies and the private sector will have to respond by promoting not only energy efficiency but also clean-burning fuels and renewable energy resources.

Citizens must also recognize that the industry by itself is not the only polluter. Our consumer-oriented demand-driven lifestyle creates many problems as well. Let us remember that sustainable development must also require a lifestyle change. But, in spite of the apparent urgency for action, it is clearly not happening overnight. Education programs in schools have an important role to play in this regard, but education should not be restricted to schools alone. Some of us may be out of the learning mode but we should also accept the opportunity to try.

Nevertheless, meeting the needs of both the energy and environment at home and abroad is a new reality of the energy industry. Integrating environmental and economic factors into decision-making is essential. Farsighted companies will recognize this, and will plan for the long term. So will our international competitors. The Government of Canada has an important continuing role in addressing environmental and energy issues. We are consulting with the provinces, the energy sector and the environment groups to develop effective policy responses. In the future, as economies of developing countries grow, so will their need for energy, and this is perceived as both an opportunity for business and a threat to their environment. It is an opportunity, because the sheer numbers of people and growth in the world population, and the ultimate market potential is huge. It is perceived as a threat, because as the densely-popu-

lated developing countries become more prosperous and industrialized, the magnitude of increased demand of energy will obviously increase the possibility of environmental damage.

Leading up to the UNCED conference in Rio de Janeiro, there have been several international meetings to try to shape an agenda. Developing nations indicate that they are not prepared to restrain economic growth to satisfy fears in the industrialized world about global warming. Instead, the developing world expects the industrialized nations to trim their own energy use, and help them achieve energy efficiency as their growing economies demand more and more energy.

The upshot is that developing countries want energy development and energy-efficient products. On the other hand, industrialized countries, quite rightly, are not about to take on heavy-handed measures to reduce their energy consumption, because that could cool off their economies and stifle their abilities to compete just when we need it most. And they are not about to sign a blank cheque for energy assistance to the developing world.

We must remain responsible. Our products should not contribute to more environmental problems but should provide what the customer needs. For example, there is an urgent need to address the growing use of coal and petroleum in the world. Due to the availability, technology and economics, we are going to continue using fossil fuels. Considering the impact of the atmospheric quality and the greenhouse effect, it is imperative that we supply the need for environmentally-friendly technology and energy efficiency services throughout the world.

The fact of the matter is that more and more people recognize that we have to find a balance between industrial activity and the health of the environment. We believe that energy efficiency can play a key role in our drive to meet the challenges that the future will bring. We need the realist with the ideal to pass on the environmental sustainable world to our children. And we need the idealist to recognize that without economic development, support for environmentally friendly initiatives is undermined. I trust that we will find both in this audience.

I thank you very much.

Scotty Cameron: Thank you, John. I now call on Bob Wyman to thank Mr. MacDougall.

Thanks by Bob Wyman: Thank you, Scotty. John mentioned at great length the subject of efficiency, and I think, given the fact that we had an overflow crowd tonight, that somebody had to become quite efficient in a hurry to find everyone a seat.

On behalf of the Energy Council of Canada and of B.C. Hydro, John, it's my responsibility to say thank you tonight, not only for addressing us but also for coming out to Vancouver during a day which must be very difficult for your Minister and for the Ministry itself. We appreciate the effort you've made to be here tonight.

Specifically, you referred at length to the subject of energy efficiency and I can't help but compare that with the objective that we at B.C. Hydro have, not only to be efficient but to be increasingly competitive. Canadians are too often accused these days of being uncompetitive, and certainly as far as the energy contribution we make to the industrial equation is concerned, it is our objective to be not only efficient but also extremely competitive.

I was delighted to hear your comments regarding the demand side of the equation, specifically, Power Smart. Energy Mines and Resources and Power Smart Inc. have had a long-standing relationship which I trust has been mutually beneficial, and in that context, today we signed the agreement on the building initiatives. You also referred to the ceremony which we are very pleased to have been a part of today. During our two- to three-day program here, we will be working to more clearly define many of the initiatives that you have mentioned during your address and you, in some ways, have put those initiatives in proper context. We want to thank you not only for the effort of coming here today but also for the words you have brought to us.

We thank you very much.

Scotty Cameron: Thank you, Bob. We haven't a formal head table but there are few people here tonight that I would like to acknowledge, and I ask them to stand when they are introduced. Please withhold your applause until I've introduced them all.

First is the Honourable John Penner, the Minister of Energy from the Province of Saskatchewan. Secondly, Mr. Alex Taylor, who is President of AGRA Industries and is the past Chairman of the Energy Council; Dr. Stan Hatcher, the President and Chief Executive Officer of Atomic Energy of Canada Limited, and the Vice-Chairman of the Energy Council of Canada; Dr. John Foster, the President of the World Energy Council; Mr. John Sheehan, Vice-President of Environmental and Corporate Affairs for B.C. Hydro and our Forum Chairman. And finally, Mr. Bob Wyman, who was just up here, who is Chairman of B.C. Hydro. Ladies and gentlemen, these are your special guests this evening.

Please enjoy your dinner. We will be back at the close of dinner to adjourn this banquet session. Thank you.

Energy Imperatives

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

The Right Honourable Ed Schreyer served as Governor-General of Canada from 1979 to 1984. In a long and distinguished career, he has been a member of the Manitoba Legislative Assembly, a Member of Parliament, the leader of the provincial New Democratic Party, Premier of Manitoba and leader of the Opposition.

Mr. Schreyer received the degrees of Bachelor of Arts, Bachelor of Education and Master of Arts in international relations and economics from the University of Manitoba, where he later taught political science and international relations.

Energy Decision-Making: A First Nations Perspective

Bill Wilson

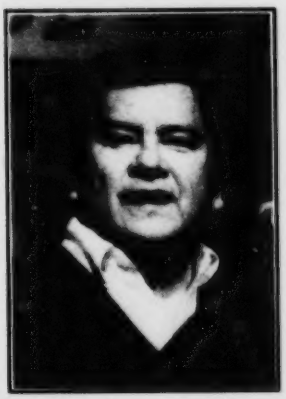
Political Secretary, Assembly of First Nations

Introduction of Bill Wilson by the Right Honourable Ed Schreyer

Good morning, ladies and gentlemen. Welcome to the second day of Energy Forum '92. I'm Ed Schreyer, and I will be your Chairman for this morning's sessions of Energy Forum '92.

And to begin this morning, our first speaker is Hemas, or Mr. Bill Wilson, the Political Secretary of the Assembly of First Nations. I should mention that Bill maintains ties with his own Nation, the Kwakiutl Nation, through his position as political coordinator of the Tribal Council. Bill has had a lengthy involvement in local provincial and national organizations dealing with aboriginal concerns including the Union of British Columbia Indian Chiefs, Native Court Workers and Counselling Association of British Columbia, British Columbia Association of Non-Status Indians, the Native Council of Canada, the Musgamagw Tribal Council and the First Nations Congress. Bill holds a Bachelor of Arts degree from the University of Victoria and a LL.B. degree in Law from the University of British Columbia. So without further ado, I would ask you to welcome Bill Wilson to the podium.

Thank you very much, Mr. Schreyer. And thank you for inviting me to Energy Forum '92.



1. Introduction

This particular room has some memories for me. I apparently got into some considerable trouble here about a year and a half or two years ago. I allegedly said something about lawyers and non-Indian people so today I won't mention cockroaches or people coming here on boats, regardless of what they smell like. Not today.

But let me begin. I flew down from Williams Lake yesterday, and on the plane was a friend of mine, Chief Roger Jimmy. He's from the Nazko Cluculz area, which is sort of north and west of Quesnel. And Roger was telling me that they celebrated their first electrical Christmas up there this last year. Now within 20 miles of where the Nazko Cluculz live, the power corridor from Hudson Hope and the WAC Bennett Dam runs south. Of course, the hundreds of millions of dollars that we spent to fuel the greed and need of Victoria and the Lower Mainland and other places, passes right through the traditional hunting territory of the Nazko Cluculz people.

2. Native People Have Always Been Excluded From Electric Power Decisions

And he said something else to me which amazed the heck out of me and is obviously relevant to my topic of decision-making in regard to Native Indian people, 'Energy Decision-making from a First Nations Perspective'. Let me put it to you this way, there is none. He told me that there has been no decision-making by aboriginal people in any manner, shape, or form, when it comes to making decisions about power and the generation of that power or the distribution of that power. Indian people have not been involved in any manner in this decision-making.

And it isn't just electric power. Power of any sort, be it electrical or political or persuasive or moral power, it has always been denied us. And I will tell you why I was so angry the one day two years ago that I was in here. I came in here and I saw a bunch of high-paid lawyers – what else is there but high-paid lawyers? – who were making decisions for Indian people. They were talking about the Sparrow decision as if it was some grandiose accomplishment, non-Indian people granting little favours through their court system to aboriginal people.

I'm afraid that really is what it's all about, whether it comes to Hydro decisions, whether it comes to electrical decisions, whether it comes to power decisions or jurisdiction or anything else. That's really what it has come down to so far in this country. Historically, aboriginal people have simply been ignored as if they did not exist. Their concerns and their interests are of no importance whatsoever to the things that go on in this country.

3. Native People Not Given The Vote Until 1949

I know that it may seem very difficult for some of you to believe, but I'll tell you a couple of facts. It wasn't until 1949 in this province, this grand province of which we are so proud, and of which I am so proud, that aboriginal people were considered citizens and were allowed to vote. That was 1949. And in the country of which my friend Ed Schreyer was the Governor General, it wasn't until 1960 that Indians were allowed to be citizens.

My father died in 1959. He kept a hundred people of his own family alive and about 300 people in the nearby non-Indian community alive by his efforts. He sent sons to war, educated kids to go to university, to become leaders and yet he died one year before he could be a citizen of this country. Some 300 families in the Comox valley owe their existence to my father. He made money fishing and trucking and hunting and logging and doing other things and yet never did he ever enjoy the privilege of citizenship in this country.

I mention that to you because his story is not that much different from the lives of most people in aboriginal communities, except there was a successful outcome for the Aboriginal people in these communities; they were granted citizenship in 1960.

4. Inherent Right to Self-Government

But things are changing. I certainly have no desire to be negative. I understand that yesterday it was announced by Intergovernmental Affairs or the Constitutional Minister, Mr. Joe Clark, that the Premiers, the Aboriginal People and Mr. Clark have agreed to enshrine the inherent right to self-government in the Constitution. My goodness, it's 1992, and we are now about to enshrine in our constitution something that is a basic right, a God-given right of all individuals on the face of the Earth, whoever your God may be, whoever she may be, and it's amazing to me, but it's progress. I'm pleased as punch and I hope to see the National Chief either this afternoon or tomorrow, because I know if it wasn't for Ovide Mercredi and the kind of leadership that he has provided, leading certain ignorant premiers around by the nose, we wouldn't have the possibility of the inherent right to self-government being recognized in the constitution.

But I mention it to you because the whole concept of the inherent right having to be enshrined in the Constitution is crazy, and let me tell you why; that right is born in you. You can't take it away, you can't award it. All you can do is either enhance the exercise of it or prohibit the exercise of it. Anybody that knows anything whatsoever about human rights must understand that rights cannot be given and rights cannot be taken away. All you can do is prohibit the exercise of them or enhance the exercise of them.

I'll give you an example that will appeal to women, I'm sure. Women are running around reading Vogue magazine articles about how they should look and what they should wear and doing all the other stupid things that men tell them to do. They try to live up to the expectations of men, rather than living up to their own individual concerns. I've asked many women this and some of them get the answer wrong. I ask them, 'Do you require the approval of men in order to be free?' Think about it. Of course, you don't. Of course, you don't. If you do, you have surrendered your decision-making authority and your individuality to someone else.

5. Lack of Communication

Aboriginal people, unfortunately, have been forced into that position for far, far too long. I was in Williams Lake yesterday meeting with the Chiefs of the Cariboo Tribal Council and they were, subsequent to my meeting with them, meeting with the town council of Williams Lake. Anybody from Williams Lake? Well, you know the kind of town council you have. I won't bore you with the rest of this story. No, it's an ordinary town council, it's an ordinary kind of town, but they have many, many problems and one of their basic problems is not talking to each other and understanding what goes on, not appreciating the roots and the issues that affect people, not understanding and sitting down face-to-face with each other and talking from the heart.

And I talked to members of the Cariboo Tribal Council later on, in fact I had dinner with one of the chiefs, and she was so incredibly frustrated that she said, 'These people are just plain ignorant.' I said, 'Well, if you use ignorance in the proper way and the proper dictionary meaning of lacking in information, I would agree with you.' But these people are just ordinary people. If you provide them with enough information and allow them to make decisions, talk to them on a regular basis, perhaps we can reach some understanding.

But her problem, of course, was that the town Councillors believe, as far too many of us believe in this country, that if Aboriginal people would just act like them, everything would be okay. Unfortunately, we are emerging from a kind of relationship that dictated that that's the way it was. That was our whole relationship. The assumption upon which this country was based was that Aboriginal people were inferior and non-Aboriginal people were superior. And we see it in all of our institutions, we see it in the Department of Indian Affairs, we see it even being replicated now by the Provincial Government in setting up its Aboriginal Affairs Department. Non-Indian people are superior, their religions are superior, their form of government is superior, therefore let us impose it on the Aboriginal people, and if only they would understand the wisdom of our knowledge and experience – who cares that they've got 30,000 years on the land – everything would be wonderful.

6. Aboriginal History Extends Over 30,000 Years

And it's like that with all the things that we do. You have only to look into yourselves and the arguments that you get into with your neighbour or your business partner or other people or the people with whom you work to realize the problem. You say, 'Gosh, if they could only see my point of view, everything would be all right.' and then you expand that to take in racial lines. You think, 'If they would only listen. If they would only worship at the same church. If they would only recognize our form of government as being superior.' They are saying this to aboriginal groups across the country who have been on the land for 30 or 40 thousand years.

And what's their way of undermining the legitimacy of that existence on the land for that length of time? 'Well, they are just descendants of Oriental people that came over on an ice bridge from Siberia.' Nuts. That's just plain wrong. Carbon dating on Northern Vancouver Island at Old Crow and other places in the Province of British Columbia indicate that 10,000 years before the ice bridge came into existence, the Aboriginal people had sophisticated societal forms equal to those of the Greeks and Romans.

The problem is that our history has never been recognized. I am just finishing reading a book by Ronald Wright which I would recommend to everyone in the world. It's called *Stolen Continents*. And he talks about five Aboriginal groups that existed in North, Central, and South American before 1492, before what's-his-name hit Haiti looking for China.

He talks about the sophistication of the Mayans and the Incas and the Iroquois and the other people, sophisticated societies that understood astronomy, understood mathematics sufficiently to predict the movement of the stars, had societal forms and stone buildings and other things that were unequalled anywhere in the world, and the shocking statistic that came through the book is that in 1492 he estimates on the basis of his research that there were 100 million native people in North America. A hundred million: and something like 20 years later, there were less than a million. 99 million people were cut down by disease, in the name of religion and other things.

7. Aboriginal Culture Is Not Inferior

I mention this because I tell you, we've got to disabuse ourselves of the assumption of superiority and the colonization of North America in the pursuit of what? Gold, mostly, and greed; that's what it was in pursuit of. It took place on the assumption that if you believed in the Catholic Church or the Anglican Church and if you believed that your race was superior, you could do anything to the Aboriginal people. You could behead them or torture them or sacrifice them because they were inferior. And I tell you and I hope that it doesn't exist in your hearts, but I do know that because of the educational system in which most of you were brought up with, which was the same one in which I was brought up with, it exists somewhere in your mind. Either in your practice or in your relationships to government, or in your attitude towards others, that somehow Indian people are inferior.

Well, I'll tell you who should be the Prime Minister of this country. He happens to be an Indian and his name is Ovide Mercredi, and there's nothing inferior about that man, nor any of the other men and women who have tried to interfere in the grand design that non-Indian people and their power corporations have for them. And what you are going to have to understand, not by way of a threat, because I don't threaten people, not by way of any kind of threat, you are going to have to understand if we are going to develop, as develop we must, be it power developments or other developments or institutional developments like the constitution, if we are going to develop in a fair and honest manner, we are going to have to abandon the assumption that men are superior to women, white people are superior to coloured people, Indians are inferior. We have to abandon those assumptions.

Even though you may not articulate it in your mind or in your voice, the reality is that the way we practice the things we do, especially when we talk about power, corporations et cetera, is based on that assumption. And I'll conclude with the examples that you know very, very well.

8. Broken Treaties

James Bay. A grand power development design fought, almost to its knees, by Matthew Coon-Come. And I remember, as Mr. Schreyer and others would remember, Chief Billy Diamond and his Herculean struggle against the power corporation that he won. Only to find out, dealing in good faith as he did, twenty minutes after the ink was dry on the 23 books of legislation, regulations from Quebec and Ottawa, only to find out the Federal and Provincial government violated every single one of them. Every single agreement that he understood to be a condition of the contract of the James Bay agreement were violated within 20 minutes.

The Government essentially said, 'These agreements are of no consequence to us.' And then they spent 28 million dollars and two years attempting to enforce conditions of a contract that they had agreed to. You see, it doesn't end. Even when you supposedly bargain in good faith your attitude is, 'Well, they didn't know what they were doing anyway. We can go ahead and do what we want to do.' Now it falls to the new generation of leaders, the brilliant people like Matthew Coon-Come to bring Quebec Hydro to its knees. And what is all of that about? It's about confrontation. It's about fighting, it's about winners and losers. It is what lawyers thrive on. And I don't happen to respect lawyers or confrontation or winners or losers. I happen to believe that we can all be winners. I happen to believe that if we will abandon for one moment our assumption of superiority or rightness, we can proceed with each other in a fair and honest manner, look each other in the eye, and start to make decisions based on mutual respect and dignity.

9. Responsibility of Leaders to Protect the Weak

I was raised as a chief. Not as an elected chief that had to get his family out to vote because the Department of Indian Affairs said we should have elections every two years; I was raised as a hereditary chief and told how to deal with people. And it strikes me that the most important responsibility of all chiefs is to protect the weakest among them; that the responsibility of the great leaders is to make sure that the weakest among them are

protected from the abuses of the few and powerful. That's what leadership is about.

10. Native People Not Consulted

I'll conclude with this story. I was driving back from Dawson Creek one time and I went into Hudson Hope and then we went on to Mackenzie and we were showing a video on the James Bay Development and there were seven or eight older Indian women in the audience that simply broke down when the scene came to where the flooding was taking place and the graves were going to be under 300 feet of water . And these women broke up and had to be taken away. I didn't know in my stupidity that the graves of their ancestors were now under 450 feet of water behind the Bennett dam in Williston Lake. No compensation, no nothing. No consideration whatsoever. They found out about the dam project when the water reached their doorsteps. That's the Native perspective of Aboriginal people in the decision-making process of hydroelectric dams and many, many other things. We have to do better than that.

Take the Kemano situation. Obviously, energy is needed for industry to provide jobs in a province that is in a depression or a recession, or a country that is in a recession. Obviously we need those things. But why didn't they, 25 years ago or 30 years ago, go and talk to the Indian people up-river? Why didn't they do the environmental assessment surveys that were necessary in order to understand what flooding in that area would do the sockeye and the other salmon? Why didn't they do it? Because they didn't care. And they didn't think that they needed to. Somehow they were not born with the moral fibre that said, 'Listen, the weakest among us are the ones that must be protected.' And they responded, of course, to the dictates of the greed in the south where Chief Roger Jimmy can live in poverty with no running water there, either. They now have hydro but still have no piped water.

Whereas the yuppies in Vancouver and Victoria, you know, they think that they're conservationists because they recycle their bottles and then jump in their BMW and turn up the air conditioning. We have to adopt a different relationship not only between ourselves and aboriginal people, but among us all. It has to be that and I'll conclude with that. It has to be a relationship that says 'Listen, what you want for yourself, I respect, but you've got to respect what I want, too.' The problems come when those two things collide or conflict. How do you and I resolve it? Do we resolve it by the strongest pushing down on the weakest? No. We resolve it by making sure the weakest are the ones that are first protected, in order to ensure that you and I can have a harmonious relationship.

11. Mutual Respect

It's so simple to me, that's what it's all about. It's about you knowing and me knowing that all of us are just as good as each other, that all of us can grow up to be the National Chief or the Prime Minister or the Governor-General of Canada. All of us have the opportunity in this wonderful land, and I'll tell you that if we incorporate the interest, the energy and the talent of the Aboriginal people into the fibre of this country, as is anticipated by the enshrinement of the inherent right to self-government, this will not be a third-class country as it is now. It will be one of the greatest countries on the face of the Earth.

Thank you.

Ed Schreyer: Bill, thank you very much. There is certainly ample time for questions. The floor microphones are open if anyone wishes to pose a question verbally.

Voice from the Audience: Mr. Wilson, I was very moved by your talk. I've been very interested in Native, non-Native relations for years. My father was a minister among you. I hope his work among your people was beneficial.

Bill Wilson: We are still investigating.

Same Voice from the Audience: Native people commonly seem to apply for grants for business ventures and then not be overly concerned what happens with those grants, so it's not a non-Aboriginal issue. Has there been consideration within your groups to deal with that question?

Bill Wilson: The question of grants and greed, you mean?

Same Voice from the Audience: Just that you don't become as corrupted as we have.

Bill Wilson: Well, I'm personally still waiting to be corrupted by some large power corporation. No, I mean, obviously, we are human; that's the whole point, and we have the foibles and weaknesses but we've never had all your opportunities and that's the real problem. And I imagine that as we develop, and as we take control of our lands, and create our self-government institutions, we'll probably have just as many crooks, percentage-wise, as you do.

I don't say that Indians are superior; otherwise I would be undermining my basic thesis. We are just human, and we will have crooks and we will deal with them in our own manner. I think that that's the essence of the inherent right to self-government. Instead of us having to live up to the expectations placed upon us by non-Indian institutions, we will have institutions of our own placed upon us and the expectations from those institutions placed upon us. I'll give you one example. I asked my mother, who is a hereditary chief as well, if she would like to have equality and do you know what she said, in a vulgar manner which I won't quite repeat?

She said, 'Why the blank would I take a step down?' Because women aren't equal in our culture, they are superior and they are superior for the basic reason, they are the only ones who can bear the children. They are the only ones that nurture the children through most of the formative years and that's why they've always been considered superior.

So the imposition of the Charter upon our lifestyle would be an infringement upon us because we don't happen to believe that men are equal. We are just different. But obviously we wouldn't want to have discrimination against men or other things because the opportunities would exist in that area. So what we have to do, it may be different than the way you do it, but we will do it our way because it's worked for 30,000 years.

But obviously there are going to have to be some standards and if there's a crooked chief, there's no one that would rather prosecute him than me, because anybody that exploits their people for their own financial benefit while people live in poverty conditions to me is not deserving of being a chief.

Gail McGee: Thank you very much for your talk, Mr. Wilson. My name is Gail McGee. I am currently on the Steering Committee of the B.C. Environmental Network, which is a network of over 200 environmental groups in British Columbia. We just had our annual general meeting and conference here in Victoria and for anybody who was watching the news or reading the Victoria Columnist, you would have seen that on Saturday morning we had a session with the Honourable John Cashore, the Minister of Environment, Lands and Parks.

I had the task of chairing that meeting, which was very fractious and difficult. One of the other speakers that morning was Gerald Amos, a chief counsellor of the Kitimaat Band. I want to tell you this story as a gesture of respect and thanks for all that your peoples have given us. When he stood up and talked after this very difficult session, he said, 'I don't want to judge you people, but I need to tell you that never would have happened among my people. It would have been unac-ceptable because you showed no respect for your guest or for each other. That's the basic thing we need to do when we are talking to each other.'

That was the first time I heard that, on that weekend. Then there was another session, where Natives who had travelled from all over British Columbia, Natives who are totally stretched by demands like constitutional talks and internal problems and, you know, dealing with things like sexual abuse and things like that, that are legacies of your relationship with our culture and they came and they spent their time with us in an afternoon session. And again, one of the most angry people from that morning session came and asked, 'How can I show respect for somebody I don't respect?' and they took time to tell us how to do that.

And then they invited us all, invited each one of us to an event they were arranging. The Gitsan Wet'Suwet'En talked about the land claims that are going on in courts and invited us to come and talk with them. The Klytlantan Nation talked about the festival they having on July 1st and they invited us. There were three different tribal chiefs from the west coast of Vancouver Island who asked us to join them in a festival on Meares Island to be held on May 23rd.

I just have to say thank you very much for showing us how people can survive incredible frustrations and incredible abuse, and still come out with the strength and the fortitude to deal with human beings as human beings. I don't believe that in my culture we know how to do that yet. And I want to thank you for what you've shown us, and what you've offered to teach us in the future. So thank you very much.

Bill Wilson: Well, I certainly can't take credit for the efforts of those people. I know that the people you talk about are extremely qualified. It's just that if we submerge any part of our society by assuming we are superior to it, or we know what's best for it, we are losing something, and whatever it is that is special about the culture of the Aboriginal people, the 27 groups in this province and the 60 across the country.

Whatever it is they have, I mean, there's something special that kept them alive, and I think we have to face the challenge of incorporating that into the fabric of the Canadian society. Because we can only benefit from it because we don't know all the answers.

Voice from the Audience: My friend, Sheila Erickson, was chatting with me recently on the telephone and she seemed very concerned about the Nechako River and the salmon spawning and she's almost as het up about that as she was about the James Bay project. Perhaps you could recap that issue for us?

Bill Wilson: I must admit ignorance. I know something about the Nechako River. I understand Alcan is attempting to restrict its flow, which will affect the salmon going up the Fraser, but that's about as much as I know about it.

I work in Ottawa for the National Chief, and the Ottawa disease, as you are very well aware of, is that you promptly forget everything that goes on across the country. No, that's not true. Except, of course, among Governors-General. (Laughter).

I am sorry, I really can't give you any details except to say that it's a common situation among Aboriginal people who are dependent upon the salmon. We see it very often in regard to Kemano or Nechako or James Bay or other places: people don't realize the importance of salmon or the wild resource to the Indian people.

I am a Kwakiutl Indian from the northern end of Vancouver Island and the mainland area around Kingcome Inlet and there, the salmon represents our life blood. It is everything to us. So when you talk about damming up rivers to produce hydro to send south to the Lower Mainland or other places, you are really talking about taking our livelihood away from us. Not that we were commercial fishermen. I mean you are taking our life out of us. You are ripping the heart out of us, and I think that people should understand that. I know that because of the Columbia dams, up in the Kootenays, my people no longer get salmon. I mean, they no longer get any salmon at all.

If it wasn't for salmon, I wouldn't be as big and fat and beautiful as I am. It's that important. I mean, you know, I could eat in restaurants or other places, but I mean if I don't eat the salmon, I'm nobody. I mean, what it is for me, to be who I am, would be gone, and I am sure Sheila and other people are in the same situation.

Phil Larstone: I would just like to say that in all the conventions and things that I attend where there are Native speakers, it is always the Native speaker who is the most moving and the most interesting and it really makes it worth while coming to these events. And my own personal opinion is that the Native perspective approaches life from a higher level and really appeals to the inner emotional strength and heart of us all and I think that's what makes a difference.

I wonder if you had any specific ideas on how energy utilities and energy decision-makers and energy corporations could incorporate the Native perspective in their decision-making and make it inclusive to the Native concerns and be sensitive to your needs?

Bill Wilson: The basic way to do that is to go and talk to the chiefs and the leadership. Don't attempt to recruit token people to your staff that would somehow justify your involvement. Go and talk to their chiefs and their councils. I mean, wherever hydroelectric projects go on, there are Aboriginal people. It doesn't matter where you do it, just go and talk to them. It's as simple as that. I mean it's like talking to your kids or talking to your parents or whomever. Just go and talk to them.

In regard to your comment, I've also noticed that Indian people are always the best speakers at conventions. Well, that might be my own racial bias, I don't know. They do speak well and for a very good reason; because our culture is an oral culture. If you are educated as a chief by your tribe, you are required to speak, I mean even without a microphone you are required to speak.

Which reminds me of a funny story. You all know Jack Munro. I was on a panel with Jack Munro in Penticton and Jack Munro got up and some yuppie working in his organization convinced one of the greatest standup speakers in the world that he should read his speech. And Jack Munro was reading like this: 'And, it, is, with, a, great, deal, of...sincere...pleasure...' Anyway, I was on the panel with him later on and I said, 'Jack,' I said, 'you ought to fire that yuppie speech maker of yours. Don't read your speech. You are the greatest stump speaker I ever saw.' And I repeated how he sounded. Anyway he got up in the rebuttal period and he said in his own vulgar manner which I won't repeat. He said, 'If that over-educated, egotistical, f–ing Indian doesn't believe I'm sincere, I'll read this speech to him again.'

Ed Schreyer: My notes, Bill, which I won't read, call for me to thank you, but you can judge from the sustained applause for yourself that your speech has been very well received and much appreciated.

So you've done well and by your own admission you are looking good. So if you are doing good and looking good doing it, then what else is there left to say? Thank you very much. Thank you very much, indeed.

Estimating Electricity Conservation Potential: A Collaborative Process in British Columbia

Nancy Cooley

President, Cooley/Olson, Inc.

Introduction of Nancy Cooley by the Honourable Ed Schreyer

I am now going to call on Nancy Cooley, who will be speaking to us about estimating electricity conservation potential in British Columbia, using a collaborative process.

Nancy Cooley is president of Cooley/Olson Inc., which offers services in planning, organizational development, participatory processes and team-building. She has specialized in complex subjects that require inter-disciplinary and inter-agency approaches as well as public involvement. She has been involved in the planning and development of B.C. Hydro's Power Smart initiative and is currently Chair of the Collaborative Committee for the 1991 Conservation Potential Review, the first collaborative process in the utility industry in Canada. And she also co-ordinates this review for B.C. Hydro.

Please welcome Nancy Cooley.

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1. The Enemy is Us

As I was listening to the presentations yesterday, I was reminded of a very old Pogo cartoon, it must be 30 years old now, that appeared during the first-ever Environmental Week, and it featured Pogo reclining against a tree in a very relaxed pose, with a big sign saying 'Environment Week' and he was saying to a friend of his, 'We have met the enemy and they is us.'

I sometimes think that we have not yet fully faced the fact that we are the enemy, and we have a great deal to learn about how to deal with that particular enemy. I'm pleased to be here this morning because I think I have at least one small example to share with you of some people who have been grappling with the enemy, and so far, I'm pleased to say, that the battle has been successful.

2. Collaborative Conservation Potential Committee

This morning, I will tell you about what we call the Conservation Potential Review and about a collaborative process that has accompanied it. It is an exercise sponsored jointly by B.C. Hydro and West Kootenay Power. Its participants include those two utilities and representatives of all the major interests in their service areas. Its purpose is to attempt to estimate conservation potential over a 20-year period in this province.

I'd like to describe the objectives of the process, our mandate and the structure under which we are operating. Later, I'll introduce you to some of the committee members who are here. I want to tell you briefly about our decision-making process, the way that we have attempted to come together and I'd like to share with you the first milestone in the process, which is the estimate of conservation potential in the industrial sector.

Incidentally, utility people also call energy conservation 'demand-side management,' or DSM for short.

3. Objectives

Three main objectives were identified for the study. The first major objective was to estimate electricity conservation potential, for two purposes within the corporation. One was to aid in planning the Power Smart initiative and the second was to assist in planning the resource mix that B.C. Hydro must pursue to meet future electricity needs.

More importantly for this exercise, the second major objective was to do that in conjunction with the interested public in B.C. Hydro's service area, and to reach agreement with that public on what those estimates were. It didn't start out as a collaborative effort; it began as an advisory effort in the late winter and early spring of 1990, when B.C. Hydro decided to do a more extensive, in-depth estimate of potential than it had a chance to do in the previous few years, as it was creating the Power Smart initiative. It began with the distribution of draft terms of reference to approximately 70 individuals and organizations who had expressed interest in electricity planning and conservation. It was subsequently advertised in newspapers around the province and, in fact, drew a surprisingly strong response.

The third major objective of the committee was to try to find a vehicle that would tap the incredible

knowledge and creativity of people all over the province who have been trying to promote energy efficiency and energy efficiency measures, to capture their knowledge and experience in our deliberations, and also to bring into the decision-making process representatives of all the major interests around the province so that the review, in fact, reflected those interests; to disseminate the review as widely as possible so that they could be discussed and criticized and commented on by all those in the province who were interested; and last, but certainly not least, to use the review itself to build both community and utility support for conservation as the preferred resource.

This third objective is a reflection of the scepticism, I think, of some of the members when they came into the process as to whether either one or both of the utilities involved were truly committed to conservation. They saw this exercise as a way of helping to strengthen what they questioned as a commitment. I think part of the value of the exercise is that both the utilities and their customers have come to understand one another's perspectives and as our members can tell you later, I think there is considerably more, shall I say ease with the thought that the utilities are, in fact, committed to pursuing conservation in an aggressive manner.

There was very strong support for the review, a great deal of interest and requests from some dozen organizations, including organizations like the Council of Forest Industries, the Mining Association of British Columbia, the Building Owners and Managers Association, many environmental organizations and others who simply said, 'We think this is a great idea, and we would like to be involved in this process as it goes on.'

4. Terms of Reference

In the fall of 1990, B.C. Hydro sponsored a workshop to search for an agreement on the terms of reference, which by that time, had been rather extensively revised as a result of all the public comment that had been received, and also to see if it was possible to reach agreement on an ongoing consultative process or some sort of process that would allow those who were interested to remain involved in the conduct of the review.

This workshop took place in the fall of 1990. Approximately 45 individuals attended, representing organizations right across the province. I think, to everyone's surprise, we walked out of that workshop after two days with agreement on the terms of reference and with agreement on a collaborative process to actually run the review. The Mandate statement we came up with is shown in **Table 1**. It was quite interesting to watch the euphoria as everyone walked out of the room and then two days later, sober second thoughts of the reality of what people had agreed to began to sink in.

One of the things that I have found in more than 25 years of working with various kinds of cooperative and

Table 1: Collaborative Committee Mandate

1. Approve terms of reference
2. Select consultants
3. Approve all base assumptions
4. Determine scenarios to be used
5. Review all draft materials
6. Approve all final documents
7. Determine publicity and public information initiatives on the Review
8. Determine the distribution of the Review results
9. Recommend appropriate next steps to B.C. Hydro, West Kootenay Power and the governments

participatory processes and decision-making is that these efforts often go off the rails before they've ever started because no one defines the terms that they are using, and people walk into the exercise with very different expectations that are never clarified. And so in this workshop we spent some time talking about words and what they mean as we use them.

5. Levels of Involvement

I want to distinguish three levels of involvement here, based on the extent to which the sponsoring organization or organizations are willing to share their decision-making authority. These levels are shown in **Table 2**. The first level I call advisory. This is one of the most common level that one saw in any sort of public involvement exercise up till now, which is where the sponsoring organization basically says, 'We want to tell you something;' it is a one-way process and the sponsoring organization really undertakes no sharing of its decision-making authority. Many of us are all too familiar with this one.

Table 2: Defining Levels of Involvement

To ask for advice...	Sponsoring organization undertakes to listen but makes no promises to heed the advice offered. Decision-making is **not shared**.
To consult...	Sponsoring organization seeks understanding and agreement, if at all possible. Decision-making is **sometimes shared**.
To ask for participation or collaboration...	Sponsoring organization undertakes to reach mutually agreed on decisions with participants. Decision-making is **substantially shared**.

The second level I've called consultation. At this level, the sponsoring organization says, 'We really would like to hear what you have to say and we will heed your

advice, if it's at all possible.' At this level there is some sharing of decision-making authority by the sponsoring organization.

The third level, which I've called participatory or collaborative, is what I want to talk about this morning. It involves substantial sharing on the part of the sponsoring organization. Here the sponsoring organization says, 'We will make mutually agreed-upon decisions with you unless it becomes apparent that it is impossible to do so.' The Collaborative Committee actually runs the review for B.C. Hydro , and everyone in that room has come into that room with the understanding that they are there to make mutually agreed-upon decisions with all of the parties in that room. Now, if you can picture yourself sitting around a table with twelve other individuals, many of whom are representing organizations that historically you have been, shall we say, in less than cordial relations with; and some of whom, in fact, you might have been in open confrontation with over the years; you will understand that there was some trepidation. People came into this exercise to work with people they had been in long-standing conflict with, and said, 'Okay, we are going to sit here until we can reach agreement.'

But that is precisely what we have been doing for a little better than a year. At the end of the November 1990 workshop, there was agreement among all concerned that a Collaborative Committee would be created to oversee the review, that it would have ten to fifteen members representing specified interest areas (which I will come to in a moment), that the review would be run on a day-to-day basis by a management group which is essentially made up of utility staff and myself as the coordinator. Consultants would be hired to do the bulk of the analyses for us. Working groups would be constituted to assist with some of the more controversial areas and there would be an advisory panel made up of internationally-recognized experts. This organizational structure is shown in **Figure 1**.

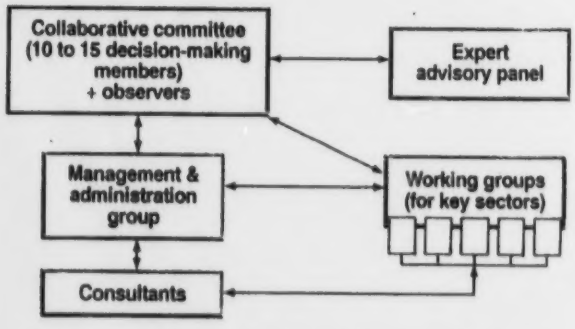
Collaborative committee (10 to 15 decision-making members) + observers
Expert advisory panel
Management & administration group
Working groups (for key sectors)
Consultants

Figure 1: Conservation Potential Review Structure

As it turned out, the expert advisory panel was never formed. The Collaborative Committee felt that they didn't require it and so it was simply never created. The Collaborative Committee's mandate is to run the review. It made the final decisions on the terms of reference; it selected the consultants who were to be hired; it makes all decisions on the major assumptions and methods that are used in the study; it is determining the scenarios that will be used in the second phase defining achievable potential; it reviews all materials and approves all documents. The committee also determines the publicity and the public information flow around the review and its process. It will be disseminating the results and determining the manner in which those results are disseminated, and its final activities will involve making recommendations to B.C. Hydro, West Kootenay Power and various levels of government in the province as to what they think needs to be done as a result of the study and appropriate follow-up action.

6. Committee Members

The Collaborative Committee is made up of 13 members representing the major areas of interest in B.C. Hydro's service area. I want to say here that the members of the committee were not selected by B.C. Hydro. The numerical membership of the Collaborative Committee is shown in **Table 3**, with the number of organizations they represent shown in brackets. The members of the committee were each chosen by the area that they are seeking to represent and each one of the members, although they come from a particular organization, tries to speak for a collection of views. The names of the committee members and the organizations that each representative speaks for are shown in **Table 4.** For example, in the industrial area, there are two representatives who attempt to speak for five organizations. In the commercial area, two representatives speak for six organizations and those organizations in most part are umbrella organizations that are province-wide. Two representatives speak for ten environmental groups. One Native organizations representative is attempting to speak for three organizations in the province, and so on. While the committee directly represents some 33 organizations, it indirectly represents many hundreds of organizations throughout the province.

Table 3: Collaborative Committee Composition

Industrial Customers/interests-2 reps(5 organizations)
Commercial customers/interests-2(6)
Residential customers/interests-2(9)
Environmental interests-2(10)
Native peoples-1(3)
Local governments-1(UBCM)
West Kootenay Power-1
B.C.Hydro-2

As you can understand, this is not an easy task. It requires a high degree of organizational sophistication and ongoing communication and a further difficulty is that you are dealing with organizations who are spread throughout the province. Our members, in fact, are geographically quite dispersed across the province, and

Table 4: Collaborative Committee Structure and Membership

Management and Administration Group

Nancy Cooley, Co-ordinator
M. Margolick, Resource Integration
J. Lewis, Energy Management
P. Chow, Load Research

P. Cochrane, F. Liebich, H. Mak, L. McClelland, G. Jung, C. Kober
P. Willis, S. Hawkins, S. Koreman, A. Cole, C. Lee

D. Chang, Communications Support

Collaborative Committee

Commercial/Business Interests
- John W. McKay, Building Owners & Managers Association, Vancouver
- Derick Turner, Canadian Home Builders' Association, Vancouver

B.C. Chamber of Commerce
B.C. Construction Association
Building Owners & Managers Association
Canadian Federation of Independent Business
Canadian Home Builders' Association
Vancouver Board of Trade

Environmental Interests
- Phil Larstone, B.C. Energy Coalition, Ft. St. John
- Randal Hadland, Peace Valley Environmental Association, Dawson Creek

B.C. Energy Coalition
B.C. Environmental Network
East Kootenay Environmental Society
Greenpeace Canada–Western Region
Peace Valley Environmental Association
Sierra Club of Western Canada
Society Promoting Environmental Conservation
Valhalla Society
supported by:
West Coast Environmental Law Association
Western Canada Wilderness Committee

Industrial Interests
- Dick Bryan, Council of Forest Industries of B.C., Vancouver
- Brian Welchman, Mining Association of B.C., Port Hardy

Canadian Manufacturers' Association–B.C. Division
Council of Forest Industries of B.C.
Electro-chemical Producers' Association
Electronic Manufacturers' Association of B.C.
Mining Association of B.C.

Local Governments
- Charles Johnson, Union of B.C. Municipalities, Enderby

Union of B.C. Municipalities

Native Peoples
- Romeo de la Pena, Union of B.C. Indian Chiefs, Lillooet

First Nations Congress
Union of B.C. Indian Chiefs
United Native Nations

Residential Interests
- Michael Doherty, B.C. Public Interest Advocacy Centre, Vancouver
- Don Scarlett, Kootenay-Okanagan Electric Consumers' Association, Kaslo

B.C. Public Interest Advocacy Centre
representing:
B.C. Old Age Pensioners' Organization
Consumers' Association of Canada–B.C. Branch
Council of Senior Citizens' Organizations
Federated Anti-Poverty Groups of B.C.
Senior Citizens' Association
West End Seniors' Network
B.C. Public Interest Research Group
Kootenay-Okanagan Electric Consumers' Association

Utilities
- Brian Parent, West Kootenay Power Ltd., Trail
- Ralph Legge, B.C. Hydro, Vancouver
- Mickey Rockwell, B.C. Hydro, Vancouver

Standing Observer
- John Hague, B.C. Utilities Commission, Vancouver

Environmental Organization Alternates
- Grant Copeland, Valhalla Society
- Ray Eagle, Western Canada Wilderness Committee
- Lenore Herb, Society Promoting Environmental Conservation
- Bo Martin, Sierra Club
- Adrienne Peacock, West Coast Environmental Law Association

so it is an ongoing difficulty for many of the members to stay in close touch with their constituencies. We also have alternates for each of the members, and in the environmental area there are five. They are identified in **Table 5**. There are usually one or two of these alternates attending our meetings. The reason for this was that the two representatives who seek to speak for environmental organizations are in the northern part of the province and those of you who come from the north or the interior know that winter travel is sometimes problematic, and so the alternates are all sent exactly the same information as the members. They are kept up-to-date with what is going on and the environmental organizations have attempted to meet on a regular basis preceding our meetings so that the two representatives can, in fact, speak from a much larger perspective.

Table 5: Environmental Organization Alternate Delegates

Grant Copeland, Valhalla Society
Ray Eagle, Western Canada Wilderness Committee
Lenore Herb, Society Promoting Environmental Conservation
Bo Martin, Sierra Club
Adrienne Peacock, West Coast Environmental Law Association

We also have a number of observers who attend our meetings regularly. The exercise has become rather high-profile. It has been precedent-setting in the utility industry; it is also precedent-setting in this province and has been an exercise that many have looked to, hoping that it will set a positive precedent.

As a result, we have more requests for observers than we can accommodate, but the committee did accept the application of one organization, the British Columbia Utilities Commission, to send a standing observer. Mr. John Hague attends our meetings in that capacity.

7. Conservation Information Database

Now, just to elaborate in a little more detail the objectives of the collaborative committee and the process itself. The objectives of the Collaborative Process are shown in **Table 6**. The overriding objective is to arrive at estimates of electricity conservation potential over a 20-year period that everyone can agree to. The group also felt that it was very important to try to create a database to retain our estimates of conservation potential, so they can be shared and used by everyone.

Many people joining this exercise were very tired of arguing about the size of resources and felt very strongly that one of the most positive things they could do would be to create a base of agreed-upon estimates; a database that could be continually upgraded and revised as we learn more about what everyone could use. Then the discussion could focus on how the resource called 'conservation' can be used, what priorities should be attached to it, what level of investment, rather than arguing about the size of the resource which is, those of you who come from other utilities will know is something that goes on quite frequently in other jurisdictions.

Table 6: Objectives of the Collaborative Process

1. To develop comprehensive estimates for British Columbia of electricity conservation potential (technological, social, economic and achievable) that are agreed upon by B.C. Hydro and its customers, West Kootenay Power and concerned interest groups.
2. To provide a common database on electricity conservation potential that can be refined and revised in the future, as more is learned about the willingness of British Columbians to conserve and as available technologies change.
3. To provide a vehicle that will allow the Conservation Potential Review to draw on the knowledge, insights and creative ideas of those who have promoted conservation and implemented energy efficiency measures in B.C.
4. To provide a vehicle for bringing representatives of major interest groups into the decision-making Review.
5. To distribute the results of the Review fully and extensively throughout the Province and to provide an opportunity for public comment on the Review results.
6. To use the Review to build community and utility support for demand-side management and conservation as the preferred approach.

I want to talk about the staff structure for this exercise because there are, in fact, two collaboratives being conducted here. There is the visible collaborative effort, which involves the utilities and their customers. There is also an internal collaboration within B.C. Hydro, and those of you who come from large organizations will know that sometimes the working relationships in those organizations are not always what one would wish. We took this exercise as an opportunity to bring together all of the key players within B.C. Hydro who were involved or should be involved in the planning for conservation, to bring them together in a much closer working relationship and in a way that we hoped would build much stronger relationships among them.

8. Supporting Staff

The Management and Administrative Group of the Collaborative Committee are identified in Table 4. The persons listed here are the key players, but within B.C. Hydro there are between 30 and 40 staff members who are involved on one basis or another, who are brought together from three or four different sections of the organization. But the ongoing day-to-day management of the review itself is in the hands of representa-

tives of three sections of B.C. Hydro, in what used to be called Resource Planning and is now called Resource Integration, Load Monitoring and Research and the Power Smart Initiative. The committee makes decisions by consensus; no votes are taken. We stay with the discussion until we have consensus, or until it becomes apparent that we may not be able to reach consensus. I am pleased to report that has not happened yet on any major subject, but I also want to assure you that it is not possible for this committee to become stalemated. As chairman of the committee, if consensus seems to be eluding us, I am authorized to take a series of actions that will enable us to either get a consensus or to conclude that there is not a consensus and to take other agreed-upon actions at that point.

The committee, I think, has been really quite pleasantly surprised by its ability to make decisions, and I think that is a tribute to the individuals who came into the process, really determined to make this work, determined to find a different way of reaching decisions successfully and the committee has really been quite inspiring to many people in the extent to which it has been able to quickly and quite civilly overcome some very substantial differences.

I want to quickly give you a sense of the subject that we are talking about, which is the whole purpose of the collaborative review process. We are conducting a study which is not unlike many similar studies that have been undertaken elsewhere in Canada and across North America to try to estimate electricity conservation potential over a 20-year period.

We are trying to see what may be possible to achieve. There are two important distinctions, that is two innovations in the study, that I would like to try to draw your attention to. One is that we have separated 'technological potential' and 'social potential,' and this is not a common practice.

What became apparent in much of the early research that was conducted for the Power Smart initiative was that British Columbians were very supportive of conservation, but felt that their own actions were not necessarily important. So we felt that it would be very useful to have at least an order of magnitude estimate of the difference that people's behaviour could make. This is depicted graphically in **Figure 2**.

9. Categories of Energy-Saving Potential

Technological potential is defined as 100 percent penetration of all those technologies which are expected to be market-ready in the near future. They are not necessarily on the market today, but are mature enough that they are expected to have become commercially available by the years 2000 – 2010. In other words, technological potential is defined as anything that requires a single decision or a single purchase. So that if you bought, for example, an occupancy sensor to control lights in your building, that would be part of technological potential. Social potential is defined as anything that requires repeated decision-making or repeated behaviour changes, so that if you remember to turn off the lights every time you leave the room, that's social potential.

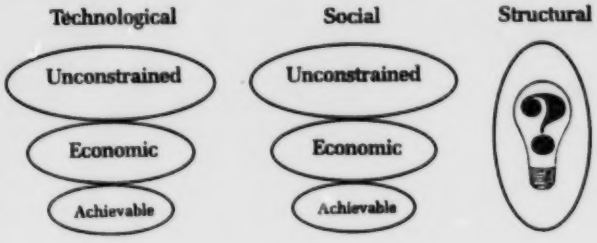

Figure 2: Scope of the Study

Economic potential is defined by the total resource cost test, comparing the cost of conservation options against all other resources that B.C. Hydro may have available to help it to meet future load.

Social potential is defined as 100 per cent penetration of all those energy-efficient behaviours that we can imagine being adopted. The first constraint on the exercise is economic, and economic here is defined from a social perspective; that is, from the point of view of least-cost options, and from the point of view of the entire province.

The second constraint that comes in, once we have defined in a sense the outside limits of the size of this resource and its technological and social limits and we've looked at what we think appears to be economic given other options, then the last step is to define what, within that range, we think may be realistically achievable under a variety of assumptions about investment and people's willingness to conserve.

We are also keeping a weather eye out for structural changes, those unexpected things that could happen in future to our society which would dramatically affect the use of electricity, whether to decrease it or increase it. Things like electric vehicles, or a dramatic drop in the cost of photovoltaic electricity, for example.

We have attempted in this exercise to take a very unconstrained view of the subject.

10. Results of Phase One

We are just now completing phase one which is the estimation of technological social and economic potential. Our draft timetable aims for the completion of the final documents for Phase One, Technological, Social and Economic Potentials, by July 1992. Phase Two, addressing the Achievable Potential, will commence in July 1992, and be conclude in the late winter of 1993.

We are about to start Phase Two, which is an attempt to look at how much, within that range, may be achievable and we are hoping that we can complete that by early winter or late winter of next year.

We have reached our first milestone: the Collaborative Committee has accepted and approved the work of the consultants in the industrial sector and we have agreement on the electricity conservation potential in the industrial sector.

This is no small achievement. This was the sector that we thought would be the most controversial. It is the first one that the committee, in fact, has reached agreement on and, for those of you who missed Jack Habart's presentation yesterday, I will just very quickly run through with you the kind of order of magnitude of what it appears that the **unconstrained** technological and social potential might be.

Results for the Industrial Sector are summarized in **Table 7**. All of our estimates are against a base of a frozen efficiency forecast. In the industrial sector it is an average frozen efficiency forecast and the consultant's view is that the natural savings in electricity energy demand over 20 years would be on the order of 8 to 9 percent improvement, in the absence of any utility action. The consultants in this review were working in a world without Power Smart, so you have to subtract the utilities current activities from all the estimates that you see here. We are estimating technological potential in the industrial sector by the year 2000 to be in the order of a 36 to 39 percent decrease from the frozen efficiency forecast. Not insignificant, as you can see.

Table 7: Industrial Sector Results

1. Natural change in electricity intensity forecast 8-9% decrease in electricity consumption **from frozen efficiency forecast.**
2. Technological potential to 2010 36-39% decrease **from frozen efficiency forecast.**
3. Social Potential to 2010: approximately 3% decrease overall **from frozen efficiency forecast.** (ranges from 0% to 17% by sub-sector)
4. Economic Potential to 2010: 37-40% decrease **from frozen efficiency forecast.** Unconstrained-assumes 100% penetration.

We were really only able to make a stab at the social potential for energy conservation in the industrial sector in this first phase of the study. I think we've done much more interesting and exciting work in both the commercial and the residential sectors. But the first estimate in social potential on the industrial side, which for the most part involves improved operating and maintenance procedures, is on the order of a three percent decrease from the frozen efficiency forecast. But there's tremendous variation among different sub-sectors: anything from zero to approximately 17 percent.

The economic potential, and this is looking at all of the technological and social potential that appears to be competitive when stacked against alternative methods of meeting the load, is in the order of a 37 to 40 percent decrease from the frozen efficiency forecast. Remember this is unconstrained, and assumes 100 percent penetration.

So the achievable levels will be something below that. The results for all industrial sectors are summarized in **Figure 3**. This is a graphic representation of both the frozen efficiency forecast, the natural change and the electric energy demand forecast and the technological and social effects of conservation. What you see there with the lines marked Econ 1, 3 and 5 are estimates of the economic potential using the total resource cost test with different environmental credits.

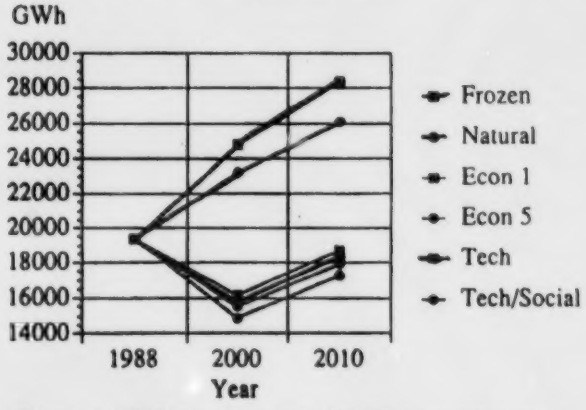

Figure 3: Efficiency Forecast: High Consumption Case

One of the subjects of very pressing concern to many members of the committee was the question of what kind of difference it would make, and in fact, more importantly what kind of environmental credits should you be awarding conservation for the reduced environmental impacts of adopting conservation as opposed to other options.

The committee did some sensitivity testing around the results, using environmental credits of 15 percent (Econ 1), 30 per cent, 60 per cent (Econ 3), and 100 per cent of the cost of new supply (Econ 5) to see what difference it would make in the potential. To our surprise and the absolute shock of the consultants, who panicked somewhat after their first model runs, there was virtually no difference between the runs at zero environmental credit and at 100 hundred per cent.

What fell out of the study was that the price of electricity is clearly not the driving factor for promoting efficiency in the industrial sector, that, in fact, the overwhelming majority of both the present technologies and those that we can judge will be on the market in next twenty years will be economic when stacked against competing alternatives.

Here are some numbers, for those of you who are not familiar with the B.C. Hydro service area. Hydro's total annual demand at the moment is about 43,000 gigawatt-hours. In 2010, the potential saving could be nearly 10,000 gigawatt-hours, nearly 24 % of today's total annual load. This gives you a sense of the magnitude of the savings that we are projecting here.

Again, I want to draw your attention to the last line, the Power Smart line. We did this study, as I mentioned, before the estimates were made of a world without Power Smart. The current estimates for the industrial programs and the Power Smart initiative have it picking up just under 1900 gigawatt-hours by the year 2010, so you see we seem to have considerable justification for increasing this target.

An indication of the conservation potential of five sectors of the industrial load is shown in **Table 8**. One of the things that we are very pleased about with this study, which used the ISTA model, was that the consultants were able to disaggregate the model to a much greater degree than had been achieved previously so that we are, in fact, able to estimate the conservation potential of many of the components downstream of the motor.

Table 8: Aggregate End-Use Efficiency Improvement, Technological Relative to Frozen

End use	Reduction, %
Pumping	60
Compression	50
Air displacement	48
Conveyance	20
Direct process machine drive	13

As a result, we think that ISTA will be of much greater use both to B.C. Hydro and to other utilities. ISTA is a public model. Everything that we've done is available to others.

11. Conclusions

The current status of the review is that, in fact, it is functioning at a much higher level than I think anybody expected. It certainly has vastly exceeded my fondest wishes for it and it has been operating with an extraordinarily high degree of commitment from its members. That is no small part of its success to date. The consensus decision-making process has been successful; there has been no major issue that the committee has encountered which it has not been able to resolve on that basis.

Organizations which, as I said earlier, had been in adversarial relationships, sometimes for a very long time, are now working together cooperatively and I think the members' evaluation of the process has really been quite positive, but they can tell you that directly. We are, in a sense, a small group of people who have moved from being individuals, some of who came into the process committed; some who came in feeling neutral; some who came in sceptical; and some, quite frankly feeling that they didn't want to be there at all, but felt that they had to be to be to protect their interests; and have become a group of people who all feel very positive about the approach and about the possibilities of using this approach in other areas.

First, I would like to share with you the views of two members of the committee, a member and an alternate from the industrial sector, who had hoped to be here this morning, but whose last-minute responsibilities prevented their attendance.

I'll read you their message. It's from Dal Scott, who is with Highland Valley Copper and represents the Mining Association and the industrial sector on the committee, and Brian Welchman, from BHP Utah Mines, who has now replaced Dal on the committee.

"We found the method of reaching agreements between a diverse group of people with conflicting viewpoints to work surprisingly well in this Collaborative Committee. Unlike most governments that listen to groups and then make the interpretation and decision, this group collectively, by consensus, has made the interpretation and decisions directly. Everyone at the meetings had the opportunity to debate from the opening bell, from the setting of the terms of reference, the selection of consultants, to the laying out of the format of the three final reports. All of the various interest groups now agree that a valid set of data has been compiled that tells us where we are today. Now comes the hard part of establishing realistic goals and the estimation of conservation potential. The completion of the first stage has given us confidence in the process. Certainly our apprehension of a year ago has diminished, thanks to all fellow collaborative committee members."

12. Reports from Other Committe Members

I would now like to call up four of the thirteen members of the committee who have been able to join us this morning.

Phil Larstone: I am an individual who worked hard to encourage Hydro to establish the Collaborative Committee project. I am feeling quite good about our successes and all the hard work that I have put into it. I think it has value. I am looking forward to more of the same in other areas of Hydro's and other resource industries' decision-making processes.

I think it's a sign of the times and it's something that there is a real opportunity to move ahead with. Of particular value to me in this process, in contrast to consultation where the proponent, or the utility, gets advice from each interest area, each stakeholder separately and contributes to the division among the sectors of society. This process throws them together at the same table and that's the only way you can work towards

a cooperative spirit between the sectors and it's a very good way to contribute to a developing understanding between the sectors. It's really helped me, because it gives me a more complete picture, a more complete perspective of all the needs and all the requirements and all the factors that go into decision-making so that my own perspective on the issue can evolve and become more mature.

Don Scarlett: When the early planning was being done to get B.C. Hydro interested in some of the concepts which were eventually implemented, a number of ideas were being put forward by the B.C. Energy Coalition, of which my group is a member. For example, if there was going to be a study into conservation potential in this province, we wanted it to be done by independent consultants. We didn't want it to be done by the same people who build major resource generation capacity. That was one of the things that was accepted. Another thing is that the stakeholders should be part of the decision-making process, particularly if there are public and environmental group stakeholders, most of whom are volunteers and who do other things in their ordinary pursuit of livelihood, there should be compensation for the time they commit to the committee.

I'm an electrician and it turns out that Phil Larstone is also an electrician. We have to give up our livelihood to a certain extent just to participate in this process. And I am very pleased to say that one of the things that was established as a basis for our participation was payment of reasonable expenses and even a modest amount for wage loss in participating. I don't want to make that sound any bigger or smaller than it deserves to be. I am just saying that without that you can't have the participation of volunteer groups who must be part of this organization to make it work.

Another thing I'd like to say is that I come from the West Kootenays. I live in Kaslo. Actually, I am not even a B.C. Hydro ratepayer; however, this conservation review was to be for the entire province of B.C. and I'm pleased to say that West Kootenay Power has been a participant, and in fact is conducting a similar study right now on it's own.

I'd also like to note, from the perspective of somebody who lives in the interior, and particularly from the West Kootenays, whose residents, I think you'll agree, are already too familiar with large hydro resource projects, is that there has been a great deal of scepticism about B.C. Hydro's motives; in fact, downright antagonism towards B.C. Hydro.

One of the things I really wanted to see happen through this process is a sense of coming to grips with this issue; the process will, I think, turn this around and make B.C. Hydro and the rest of the stakeholders work together.

Dick Gathercole: I have spent the last ten or eleven years involved in all the regulatory processes involving B.C. Hydro and basically in many respects, I suppose, fighting B.C. Hydro. One of the things I had hoped to see accomplished was the very sort of thing that has happened with this collaborative process. The clients I represented were all very supportive of it. One of the reasons it has worked so well is because B.C. Hydro really was committed to it and their staff was really committed to it. We did start out with some concern, a lot of us, that the process might be taken over by the Hydro staff. We found out very quickly that wasn't the case, and that was something I think is absolutely essential to its success.

One other thing I do want to mention is that a key factor in our success was Nancy Cooley's presence. She was unanimously chosen as Chair of the Collaborative Committee by all the participants, in recognition of her particular skills. The success of the Collaborative Committee's work is due in no small part to her role as Chair. I've learned a great deal from my participation in it and I have gained a lot of ideas from the collaborative effort that I will be taking forward in my new work with the Energy Council.

Jack Habart: I am going to come at it from the other side, if you like. I am a manager in the Power Smart group at B C. Hydro and actually before this project had started, in about December of 1990, we were scoping out a conservation potential study. It was something we needed for internal purposes and, in fact, it was two years ago, at the Electric Energy Forum in Prince George, when I was sitting in the audience and I heard our then chairman, Mr. Larry Bell, announce that my project was going to be a public collaborative study.

Needless to say I had some concerns and I thought it would be useful just to share a couple of those concerns with you, and then review what actually happened. And the first concern I had was really to do with time and it was to the extent of, 'Good Lord, if we are going to have to do this study as a collaborative effort with members of outside groups, will we ever get the project finished?' And the other concern I had was to do with quality. The concern was, as you bring a number of people in with different backgrounds, what will happen to the quality of the product?

The collaborative approach does take longer. That is a reality. It took us probably nine months to get the collaborative together, as Nancy explained, determining how we were going to structure this thing. I don't think it would take us that long to do it next time. It does take longer to do the studies and the reason it takes longer is really just the logistics. For example, when you get reports in, you are now reviewing them with a much broader group of people and you have the logistics of trying to get meetings together. But I'm pleased to say that the time increase, once we got going, is probably no

more than 20 percent. This is much less than I had expected at the outset, and is a reflection, I think of the dedication of the Collaborative Committee members, who have been really good about making this study a priority, and in turning things around as quickly as possible.

The other concern I had was quality. And I'm pleased to say, as Mr. Wyman noted in his opening remarks, we did succeed in bringing a wider range of values into this study. It is very important when you are scoping out the study.

The other thing it did was to open up some avenues for information that we would never have had without the active participation from different people in the Collaborative Committee. We were able to come up with a much richer source of data to do the analysis on. I personally believe that the quality of the product that we are getting out of this is much better than we would have had otherwise. Similarly with the time loss, when you end up with numbers that both Hydro and the public agree upon, you see less delay down the line when, for example, we are talking to the Utilities Commission about how much conservation potential is there.

So from my perspective it's been an extremely positive experience for myself. Thank you.

Nancy Cooley: We need to close it at this point in order to stay on schedule. You know who the committee members are, if you have questions or comments that you'd like to make to them, I am sure they would be pleased to talk to you, as would I. Thank you very much.

Our Changing Climate: Building the Global Response

Douglas Russell

Director, Climate Change Convention Negotiations Office
Atmospheric Environment Service, Environment Canada

Introduction of Douglas Russell by the Honourable Ed Schreyer

Our next speaker is Mr. Doug Russell, the Director of Environment Canada's office established to develop Canada's positions for the international negotiations on a Framework Convention on Climate Change. The office provides a focal point for Canada's involvement in the negotiations, including consultation with the provinces, industry, consumers, environmental groups and others.

As senior policy adviser for the atmospheric environment service, Mr. Russell led the development of the atmospheric issues section of Canada's Green Plan. A meteorologist by profession, he has worked as a weather forecaster, oceanographic specialist and has taught meteorology in Toronto. Please welcome Douglas Russell.

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1. Introduction

Thank you, Mr. Schreyer. Thank you very much, ladies and gentlemen. It's a pleasure being here today and to be able to bring you what I hope is good news, which is that we have agreement on a Framework Convention on Climate Change, a new international treaty which we hope will be signed into law by the heads of governments in Rio de Janeiro next month.

I was struck by the presentations of the previous speakers this morning. First, Mr. Bill Wilson, with his emotion, his tremendous enthusiasm for our country and his clear message for respect for our native people. And respect for each other, respect for other countries, and respect for our planet. Nancy, as well, talked about the need to discuss, need to form positions, to bring other people's ideas on board and it's encouraging to see this kind of work being done in the energy sector now.

I certainly agree that we will need this kind of respect internationally as well, particularly in the areas of energy efficiency and conservation, to deal with meeting our commitments in this climate change convention. So what I'd like to do today is to talk to you a little bit about climate change, and then talk briefly about the upcoming United Nations Conference on Environment and Development (UNCED).

But basically, I'd like to bring you up-to-date on the climate change convention that some have called the crown jewel of UNCED. It's the bellwether, whether or not major world leaders will indeed, attend Rio. I think back to last Saturday afternoon, just shortly after 6 o'clock in New York, when 147 nations stood up and applauded, I think we had a very good sign that we will, in fact, see the major world leaders at Rio.

I would like to give you an update on one of most important – yet difficult – environmental challenges we face: building a truly global response to the threat posed by our changing climate. My primary goal is to talk about preparations and negotiations under way right now to hammer out a Framework Convention on Climate Change – the critical building block of global action on climate change.

To help you understand where we've come from and where we're going, I would like to highlight:

- the nature of the global warming problem; why it really is a global problem demanding a global response,
- some of the very real, complex economic, technical and political issues that stand in the way of any 'quick fix' or quick action, and
- Canada's preparations for the negotiations –what we want from the Convention, how we have developed the 'Canadian position' and the role Canada is playing in the international negotiations.

'We cannot continue with business as usual.'

First, let's make one thing clear: global climate change is not the latest environmental fad. Not a political movement, a new age Holy Grail, or a doomsday apocalyptic nightmare. But it is real, it is happening, it will happen even if we stop all our greenhouse gas emissions at midnight tonight.

2. Evidence of Global Warming

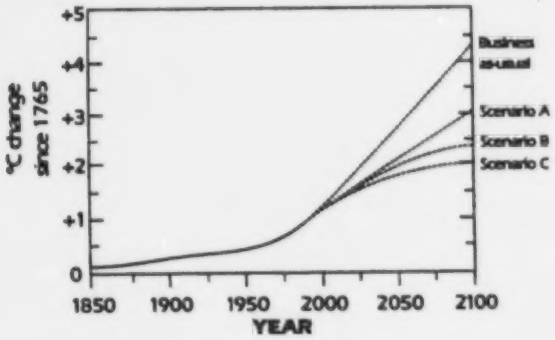
Some of the most eminent scientists of the world, brought together in Toronto in 1988 as the Intergovernmental Panel on Climate Change to provide the United Nations with the best independent, scientific assess-

ment of the situation, said this: 'We cannot continue with business as usual'. We have to act, and act now. As individuals, as nations and – as startling as it may sound – as one planet.

Yes, uncertainties exist about precise changes in temperature, and precise impacts.

But we do not have the luxury of time on our side; in fact, time is not on our side at all. I want to spend just a few minutes showing you why.

Evidence of the potential impacts of global warming is beginning to appear in Canada. **Figure 1** shows the global climate change since the beginning of the industrial era (based on model projections using greenhouse gas increases to date); about one degree Centigrade since 1765, and half of that since 1900. Over the past decade the largest increases in average annual temperatures occurred in western Canada and in the heartland of Russia. During the past decade both of these regions experienced much lower than average soil moisture conditions and substantially reduced yields of wheat. The trend will likely continue as soil temperatures increase.



(IPCC Report)

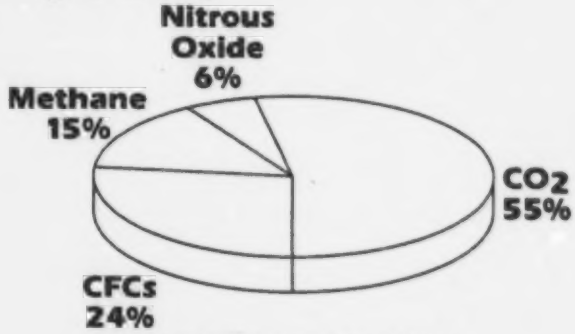
Figure 1: The Pace of Global Warming

Increases in temperature will also shift forest ecosystems northward and narrow the boundaries for some tree species. This will necessitate increase in tree breeding and forest management programs. In countries such as the USA, with a 20-year plant-to-harvest schedule, climate changes can be more easily dealt with. In the major forest production areas of Canada, the plant-to-harvest cycle is about 80 years. Climatic changes thus present much greater risks to Canada and are much more difficult to manage. From a socio-economic perspective, changes in the forest resource are much more important in Canada than in any other country. The value of Canadian exports of forest products are more than twice that of the United States, our nearest competitor.

Some examples of the longer-term implications of climate change for Canada are:

- inundation of low-lying coastal areas,
- large drops in water levels in the Great Lakes,
- increased fire, insect, and disease attacks on forests,
- degradation of permafrost, and
- more frequent and intense heat waves in cities and the northward spread of tropical diseases.

The pie chart shown in **Figure 2** identifies the major human-made greenhouse gases – the real 'culprits' behind global warming.



Contribution to global warming 1980-90 (IPCC Report)

Figure 2: The Greenhouse Gases

The Intergovernmental Panel on Climate Change concluded in its 1990 report that concentrations of greenhouse gases in the atmosphere are changing very rapidly:

- half the CO_2 added to the atmosphere in all of human history has been emitted in just the past 30 years,
- methane levels have doubled in the past 100 years,
- CFCs are doubling every 10-20 years,

About three-quarters of the warming can be attributed to CO_2, from:

- burning of fossil fuels for transportation and energy production, and
- other sources: land-use practices (e.g., deforestation) and industrial processes.

3. Greenhouse Gas Emissions

It is tempting to suggest that global warming could be resolved 'if only' the industrialized nations of the world would stop their emissions of greenhouse gases.

Canada, for example, produces 2% of the world's total human-made emissions of CO_2 – but is the second leading source on a per capita basis among industrialized nations, and seventh on per capita basis among all nations.

Industrialized nations only comprise part of the problem, as **Figure 3** shows. This map of the worldshows the annual carbon emissions by nation. The clouds above each region illustrate the carbon emissions from fossil fuels in million metric tons for the years 1960 and 1987. Note the increases in the size of the 'clouds' above

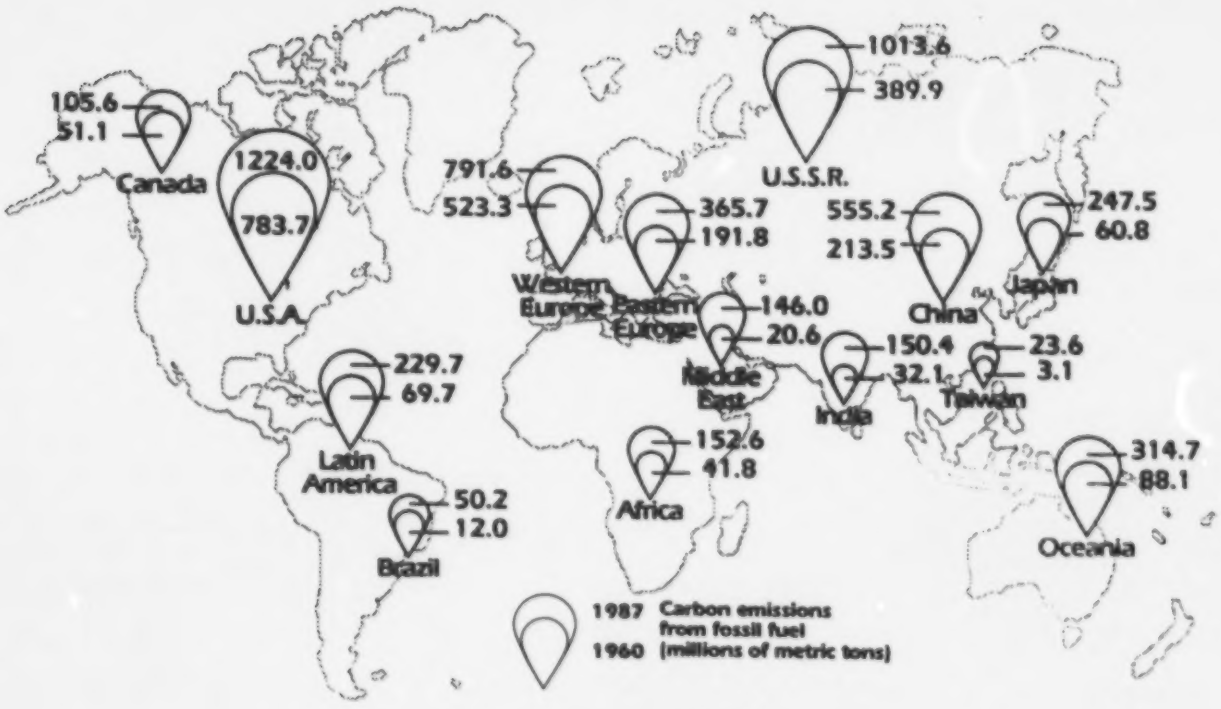


Figure 3: The Need for Global Action

USSR, China, India, even Latin America and Brazil.

The illustration demonstrates how much things can change in so short a time.

Over the last half of the 20th century, the relative shares of the major western industrialized nations have actually declined or remained steady, e.g., from 1950 to 1985, the U.S. share declined from about 45% to 22%, the U.K. from 7% to 3%, while at same time:

- USSR increased from 12% to 19%,
- China increased from 2% to 11%,
- India increased from 1% to 3%, and
- Others, largely developing nations, increased from 16% to 28%.

For the USSR, China, India, there is a one-word explanation: development. This isn't laying blame at anyone's door; it's underscoring how this is a complex problem that frustrates unilateral action.

All of this begins to hint at the complexity of issues and solutions around trying to 'cool off' our planet, or, more accurately, trying to slow down the heating of our planet.

The cartoon in **Figure 4** is perhaps only the slightest of exaggerations. Responding to global warming touches at the heart of complex issues between developed and developing nations, involving economic and social development, trade and competitiveness, international debt, population, and education.

Courtesy: Scott Willis, BOS Newsletter

Figure 4: Global Warming in an Unequal World

Perhaps nowhere in the current global economic and political landscape are international tensions and differences played out as they are in building a global response to climate change.

Developing countries are not prepared to sacrifice their prospects for economic development while industrialized countries continue what India has called 'wasteful consumption patterns in opulent societies.'

Figure 5 tries to get across this polarity in viewpoint; the difference in perspectives at work as nations sit down at a table to hammer out an international agreement.

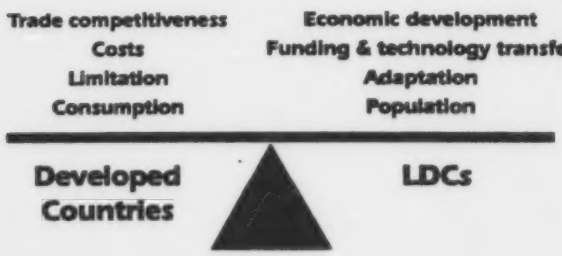


Figure 5: The North-South Dimension

For industrialized countries, global warming is predominantly seen as an environmental issue; for less developed countries (LDCs) it is a development issue. No solution can be isolated from these broader political/economic questions. This is a global problem, requiring global response.

Some observations are worth noting:

- the level of impacts rarely match a country's particular contribution to greenhouse gas emissions – some of the poorest countries are especially vulnerable, e.g., Bangladesh,
- cooperation among nations is needed not only globally, but regionally and between developed and LDCs, and
- successful response strategies will need to be flexible – reflecting specific circumstances, no 'single' solution for all.

4. Canada's Action Plan

That's enough of the problem – let's start looking at solutions. What do we mean by solutions? What are we looking for? Three things, I think, all of which need to run concurrently:

1. First, a set of international treaties – commitments, targets and assistance.
2. Backed up by national action implementing the promises set out in treaties, and setting the stage for further international action.
3. All based on individual action, need for education, awareness, lifestyle changes and choices.

Figure 6 suggests that, even in the face of significant obstacles and complex issues, there may be cause for optimism. There is a momentum being built up, a growing sense of consensus around the need to talk, but to do even more: to act.

Each one of these is a major building block in international environmental action.

And while the immediate goal is a signing of the Framework Convention on Climate Change in June 1992, that too must be seen not as the end of the road, but as yet another building block.

Taken together, these steps hold lessons for us as we set to enter the 21st century. What have we learned from these?

How to negotiate.

How to be patient: to achieve the 'achievable' step-by-step – try to get as much as possible from each step, but recognize that it's an on-going process.

How to work together, finding common ground and common responses.

Let us turn now to look in detail at the Framework for Climate Change: What will be signed at UNCED? See **Figure 7.**

Here is a preview of what the table of contents of the framework convention looks like.

Preamble

A framework of general principles and obligations for signatories

Commitments

- Emissions: limiting emissions and enhancing role of 'sinks' (sinks absorb greenhouse gases) — forestry and agriculture (e.g. LDCs curbing deforestation).
- Funding: how to pay for these commitments? developed nations to assist LDCs?
- Special cases: how to address the special cases, such as 'small island' states?

Mechanisms

- Institutions: how will Framework Convention be set up to operate?How will we keep momentum after Rio?
- Science and observation: cooperative scientific research and monitoring, and on-going scientific review
- Compliance and review: how to ensure compliance? require reports? independent verification?
- Funding and technology: again, what is the role of developed and developing countries here?

The key groups involved in negotiating the Framework on Climate Change are shown in **Figure 8.**

Now, let us move from international activities, in which Canada is a major player, to look at more detail at what's happening inside Canada:

- What is our policy right now on global warming?
- Who's doing our negotiations?
- How are Canadian positions being arrived at?

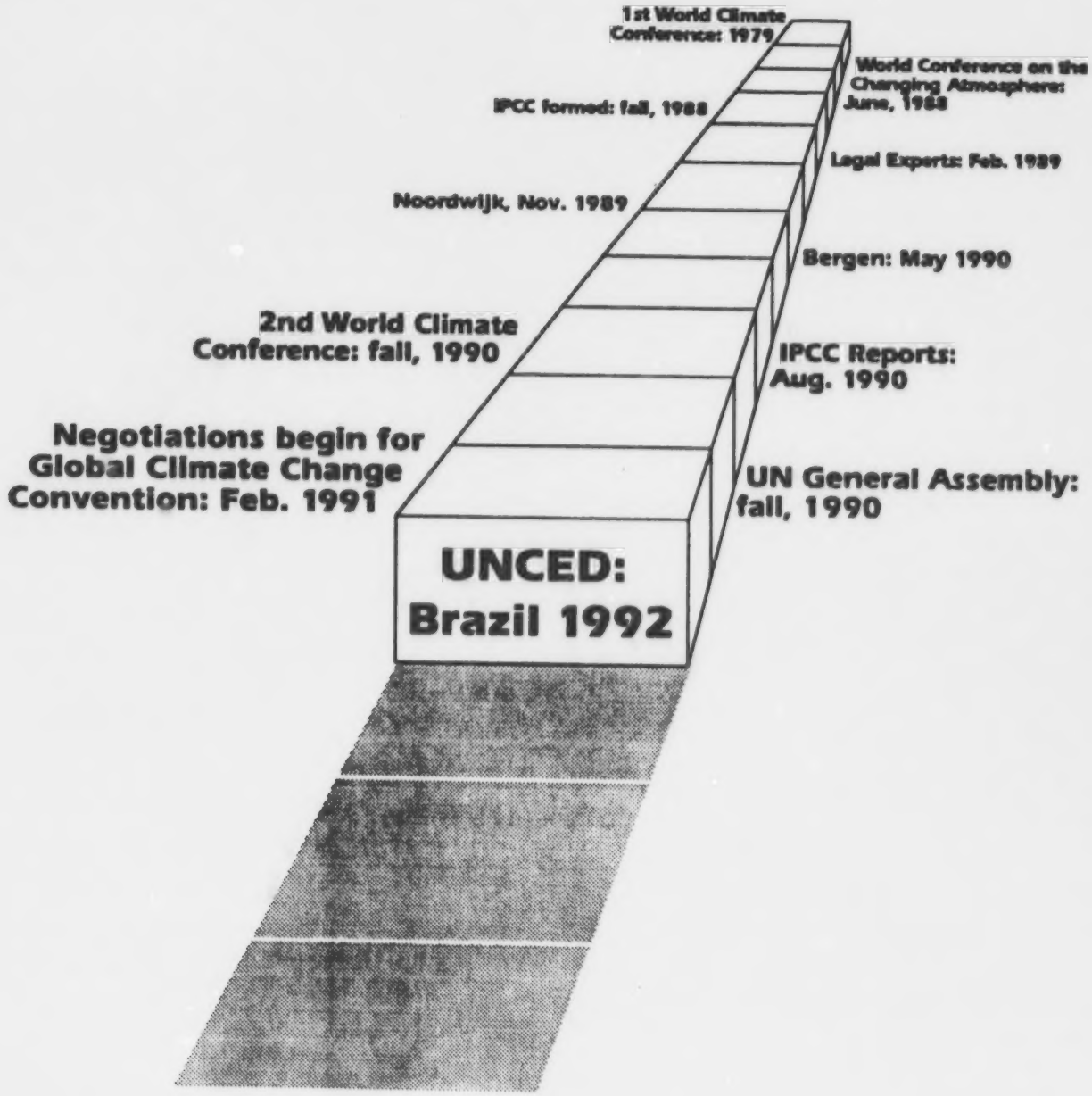

1st World Climate Conference: 1979
World Conference on the Changing Atmosphere: June, 1988
IPCC formed: fall, 1988
Legal Experts: Feb. 1989
Noordwijk, Nov. 1989
Bergen: May 1990
2nd World Climate Conference: fall, 1990
IPCC Reports: Aug. 1990
Negotiations begin for Global Climate Change Convention: Feb. 1991
UN General Assembly: fall, 1990
UNCED: Brazil 1992

Figure 6: Building Momentum for Global Action

- And what do we want out of the Framework Convention?

And the 'how' is important; not only does it lend credibility to our positions in international negotiations, but it stands as a model for future work on building cooperative far-reaching approaches to complex environmental problems

Canada is doing much more in responding to global warming than just participating in the international negotiations; there is considerable activity at

home – we cannot wait for signature of an international convention; our Green Plan sets out Canada's policies and current activities; Federal government working with provinces to develop a National Action Strategy, as shown in **Figure 9.**

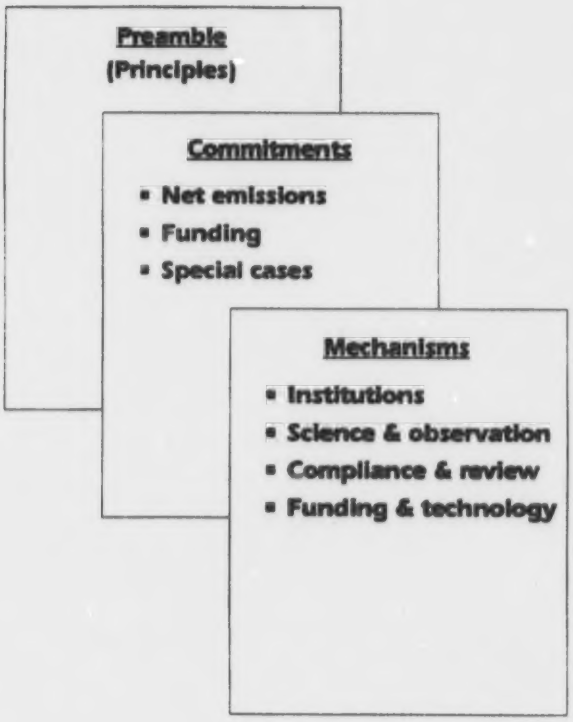


Figure 7: The Framework Convention on Climate Change

Canada's action plan has thefollowing three cornerstones:

1. Limit Net Emissions

The immediate goal: as a first step, stabilize CO_2 emissions and other greenhouse gases not controlled by Montreal Protocol at 1990 levels by 2000. Consider other 'first steps' that make a lot of sense in their own right:

- Bilateral federal-provincial/territorial planning,
- Improving energy efficiency through efficiency standards,
- Promoting alternative energy sources,
- Improved education/communication to inform Canadians, and
- Tree-planting and agricultural practices.

Continued work and assessment required to ensure stabilization; e.g., assessing impacts economic instruments to encourage sound actions; demand-side management of energy; pricing and regulatory structures; urban planning changes – some of these are responsibility of provincial and municipal governments

2. Anticipate and Prepare

Socio-economic implications:

- Great Lakes/St. Lawrence Lowlands,
- Prairies, and
- Mackenzie Delta.

Guidelines for considering potential climate change impacts in major projects.

3. Improve Scientific Understanding

Going beyond 'first steps', as well as preparing for climate change, will require greater level of understanding; we need the best knowledge possible to make effective decisions and policies:

Climate change rates, regional impacts, role of oceans, role of agriculture.

We need to communicate this knowledge to the people that count – decision-makers within government and industry, and consumers – you and me.

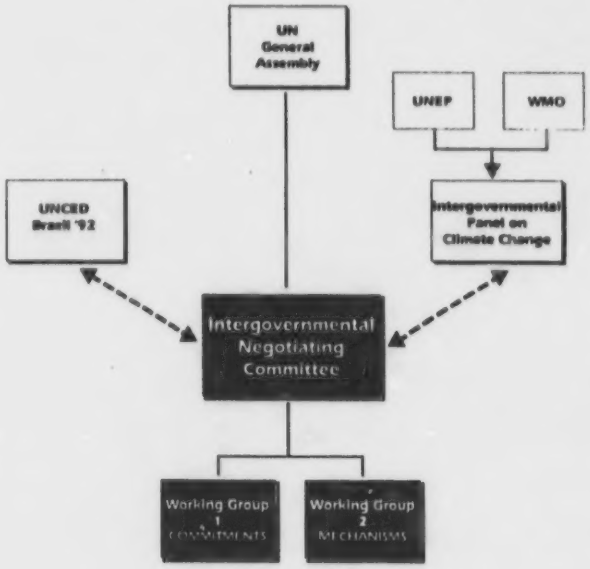


Figure 8: Negotiating the Convention

Canada's 7 major negotiating objectives are listed below: what we hope to see come out of the Framework signed in Brazil, what we are working for around the meeting tables. We need to distinguish between what we want out of a 1992 Convention and what we over the longer-term. We should try for as much as possible for 1992, but acknowledge that it is a long, progressive process; the Montreal Protocol on ozone depletion is a good model that went as far as it probably could, but had built-in review and update mechanisms.

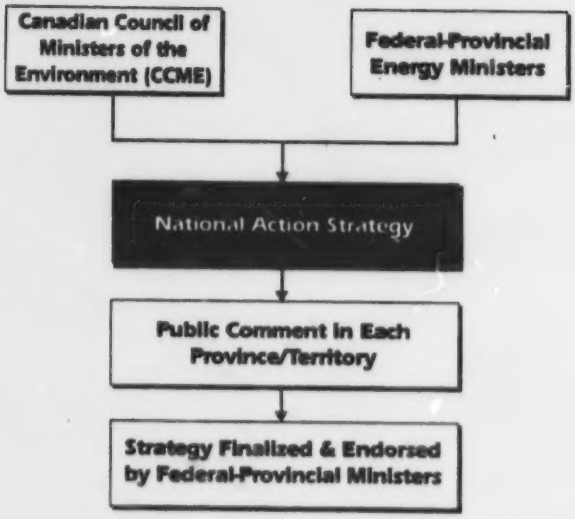

Canadian Council of Ministers of the Environment (CCME)
Federal-Provincial Energy Ministers
National Action Strategy
Public Comment in Each Province/Territory
Strategy Finalized & Endorsed by Federal-Provincial Ministers

Figure 9: Developing the National Action Strategy

1. Global

• Included as many countries as possible, for a truly comprehensive framework; including a balance of countries – the developed, LDCs, trade partners and competitors.

• Permitted significant action to be taken to reduce impacts of climate change.

• Need to bind as many as possible so as to not unfairly disadvantage anyone and to discourage 'free-riding.'

2. Comprehensive

• Not narrow: all greenhouse gases should be covered, including their sources and sinks, as well as all economic sectors.

3. Flexible and Phased

• Identify realistic and evolving targets, taking into account different impacts and capacities of regions to respond, and of our improving understanding.

4. Targets and Schedules

• Need to go as far as possible, yet be realistic, achievable, e.g., Green Plan.

• Also need to be common targets, while allowing for national design of implementation.

5 Commitments to Action

• Needs to be real action; more than high-sounding promises; needs to be supported by specific national implementation targets and programs.

6 Best Available Science

• IPCC report's judgement that human activity has significantly affected climate.

7. Ongoing Review and Update

• Ensure on-going review of commitments and schedules to incorporate improved scientific understanding.

In addition to the 7 major objectives, there are these additional negotiating objectives:

Precautionary

• In face of possible irreversible environmental damage, lack of full scientific certainty should not be used to postpone action; priority should be given to those measures that make sense in their own right.

Education

• Encourage development of education programs to further public understanding of the problem and of impact of individual behaviour.

Economic instruments

• Allow for countries to use a balanced approach involving not only regulation, but market forces, recognizing efficacy of apply economic instruments in a cost-effective manner.

Regional Approaches

• Just as our domestic objectives reflect a regional sensitivity, so too should regional flexibility be reflected in the Convention.

• Address technology transfer and financial assistance to LDCs, possibly linked to specific obligations.

• Allow for bilateral or regional approach to meeting Convention obligations, as long as cost-effective and doesn't detract from equitable sharing of burden.

The Federal/Provincial National Action Strategy is shown schematically in **Figure 10**. Federal-provincial aspects comprise an essential element of Canada's national position, given the sharing of environmental powers under our Constitution.

The Provincial/Territorial Advisory Committee on Climate Change (PTAC): Addresses two major areas:

- Energy: input through Deputy Minister's (DMs) committee reporting to Ministers of Energy,
- Environment: input through DMs committee, reporting to Council of Ministers; DMs committee supported by an Environmental Protection Committee and its Atmospheric Issues Task Group, and
- PTAC seeks advice from and informs other provincial/territorial departments as required, e.g., agriculture and forestry.

If war is too important to be left to the generals, then a global response to climate change is too important to be left to governments alone.

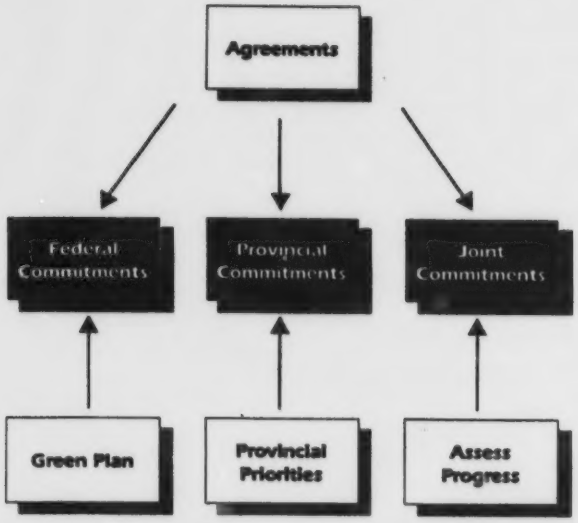


Figure 10: Federal/Provincial Territorial Agreements

Views of individual Canadians, in their roles in industry, consumer and labour groups, must be reflected in whatever we are propose to do about climate change.

This is a major feature of Canada's preparations for the Framework Convention.

The key institution for building the views of non-governmental sector into Canada's positions is the Climate Change Convention Advisory Committee (CCCAC), as shown in **Figure 11**.

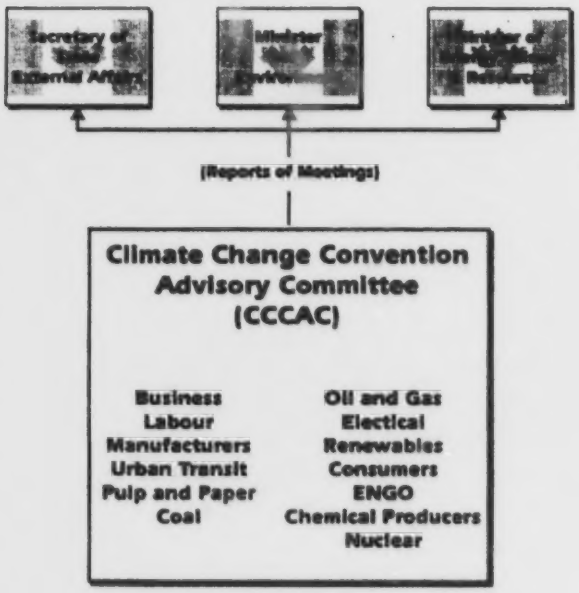


Figure 11: Climate Change Convention Advisory Committee

The Committee is co-chaired by representatives from Environment Canada and External Affairs.

CCCAC membership: all key industrial sectors are represented – the ones who will have to make the real changes in terms of practices and policies – energy production, manufacturing, transportation; as well: consumers, labour, some members of the environmental community.

The Committee offers advice to the three federal Ministers: not necessarily a consensus, but a thorough airing of views and concerns.

How the Canadian Mandate will be developed is shown schematically in **Figure 12**. This shows the process of developing our position.

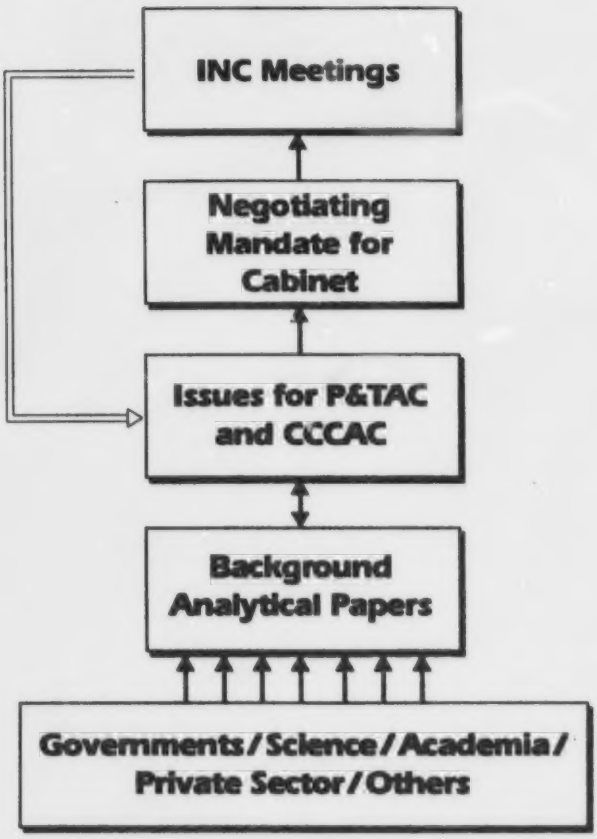

INC Meetings
Negotiating Mandate for Cabinet
Issues for P&TAC and CCCAC
Background Analytical Papers
Governments / Science / Academia / Private Sector / Others

Figure 12: Developing the Canadian Mandate

How does all the input and advice fit together? It begins with development of background papers by independent scientific and technical experts, on about 30 different subjects, under several major headings:

- Commitments,
- Forests and agriculture,
- Energy,

• Funding and technology, and
• Trade and economics.

Background papers are the basis for discussion in the advisory committees. The 2 advisory committees, CCCAC and PTAC, provide advice to negotiators for transmittal to Ministers:
• On positions to be taken by Canada, and
• On relevant issues to be raised in negotiations.

Federal team: interdepartmental development of response strategy; ultimate decisions rest with the Cabinet, upon recommendations of the three lead Ministers.

Feedback results from meetings of Intergovernmental Negotiations Committee, IPCC and others: refining of positions, addressing newly-identified concerns.

The three key features of Canadian preparations for the Climate Change Convention are careful preparations, a negotiating mandate based on national consultations and scientific and policy support.

Overall, it has been well-managed; there arelots of players, but roles and responsibilities are clear – everything is 'out in the open.'
• Grounded on best available, independent scientific assessment.
• Positions based on broad consultations with stakeholders and other governments.

All of which makes Canada perhaps as well-prepared as any nation going into the Intergovernmental Negotiations. Canada is an active player in the INC negotiations, providing scientific and policy support by co-chairing Working Group 2 on Mechanisms and by contributing scientific modelling to the WMO.

We are not newcomers to the world of international negotiations; we don't view our goals through rose-coloured glasses, but rather with realistic optimism.

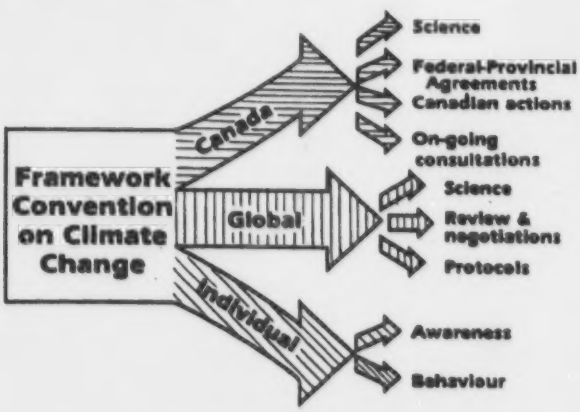


Figure 13: Beyond Brazil '92

5. Conclusion

I will conclude with an important reminder: the Framework Convention, as critical as it will be, is only a beginning – but it is some beginning. Where we may go after the Rio conference is shown in **Figure 13.**

Work must continue on three fronts: domestic, international and individual. These will include:

Domestic:
• Improving our own scientific understanding of global warming – contributing to international pool of knowledge, and towards better understanding of impacts on Canada.
• Starting cost-effective action to reduce Canada's emissions.
• Preparing the federal-provincial agreements necessary to fully meet Canada's domestic goals and Convention commitments.
•Ongoing consultations: consultations have proven their value during preparations for Climate Change Convention and will be continued in follow-up efforts.

Global Follow-up:
• Improving scientific understanding.
• Feed improved knowledge into Convention's on-going review and re-negotiation mechanism.
• Develop protocols on specific greenhouse gases and issues, such as forestry, agriculture and energy.

Individually:
• It all begins with individual decision-making. In the end, the Convention is only as good as the decisions we make.
• Underscores need for on-going education to improve awareness and promote environmentally responsible choices and changes in our lives.

'We cannot continue with business as usual.'

I began this presentation with this warning and call to action from the IPCC, the collection of leading scientists from 38 countries. I hope that by now, you have an appreciation for the reasons behind the warning, and the urgency of the call to action. I hope you understand, too, that there are no 'quick fixes,' that if there ever was a truly 'global' problem requiring a 'global' response, this is it. Thank you.

Ed Schreyer: Thank you very much, Doug. I am certain that many in the audience would dearly love to pose some follow-up questions to you but our time has run out. We are now at the scheduled end of this first Plenary Session.

It remains only for me to thank you once again, to express the frustration on behalf of many of us here that we couldn't follow-up by way of question and answer and discussion on this important topic.

Thank you very much.

Panel Discussion: Trading Western Canadian Energy

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Panel Discussion

Trading Western Canadian Energy

Panellists
Guy Saint-Jacques
Lorne Seitz
Gary Fuqua

Introduction of Panellists by the Right Honourable Ed Schreyer

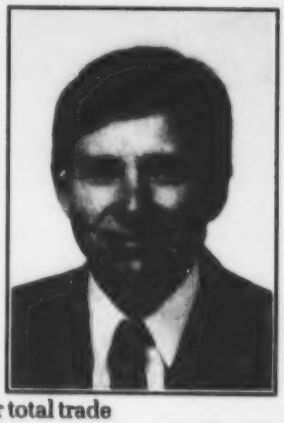
Welcome back to our second session of this morning's program. We have three panellists here this morning to lead us through a discussion on the topic of 'Trading Western Canadian Energy,' and in particular, in regard to energy trade issues between Canada and the United States.

Leading off is Mr. Guy Saint-Jacques. He represents External Affairs and International Trade Canada (EAITC), in Washington, D.C. In that role, Mr. Saint-Jacques is Energy Counsellor of the Canadian Embassy in Washington, responsible for hydroelectricity, nuclear matters, coal and related legislation. Prior to his posting to Washington, he was Executive Assistant to the Associate Under-Secretary of State for External Affairs. Mr. Saint-Jacques' EAITC postings have taken him to Kinshasa, Zaire, Hong Kong and Beijing. He holds degrees in geology from Montreal University and in land planning and regional development from Laval University.

Without further ado, I will call on Mr. Saint-Jacques.

Energy Issues Between The U.S.A. and Canada

1. An Overview of Our Energy Trade



Good morning, ladies and gentlemen. I am very pleased to be here in Victoria today. What I would like to do is to give you first a brief overview of the trade between Canada and the United States, then talk about the mood in Washington and the main issues which preoccupy us these days. Finally, I will address some issues of concern, and answer any questions you may have.

As you probably know, the trade relationship between Canada and the United States is the largest in the world. Last year our total trade was over 200 billion dollars. In the case of energy, our exports to the U.S.A. represented 12 per cent of our total exports, or 13.5 billion dollars. And since we imported 1.5 billion dollars worth of energy from the U.S.A., this means that our net energy trade balance increased by 12 per cent to reach 12 billion dollars in 1991.

I would like to highlight some key figures. In the case of crude oil, our export increased by 18.9 per cent and that had a value of 6 billion dollars. We also exported petroleum products worth 2.4 billion dollars; of that, British Columbia exported 155 million dollars worth of product. Canada is now the second supplier of petroleum and petroleum products to the United States and our share of their market is 14.3 per cent.

Our exports of natural gas went up also by 16.6 per cent, although in terms of value, they went up only 7 per cent. B.C.'s exports represented 10 per cent of those exports, with a value of close to 300 million dollars. Canadian Gas now accounts for about 8 per cent of the U.S. market and is now forecast to reach 10 per cent in about two or three years.

Following a year of record high imports from the U.S., our exports of electricity rose almost 19 per cent in 1991 for a total value of 554 million dollars. However, the increase in sales and exports was mainly in surplus sales. This also applies to British Columbia, which exported some 120 million dollars worth of secondary electricity.

2. The Mood in Washington

Let me turn to the mood in Washington. As you know, this is a presidential election year in the U.S. and while President Bush is assured of renomination, his campaign against the likely Democratic nominee, Bill Clinton, is expected to be much more of a horse race than anyone would have expected even a few months ago.

Furthermore, the Congress, which regularly returns more than 90 per cent of its incumbents, may be facing the most dramatic change in 20 years. We expect that there could be up to 100 new members in the Congress. On Capitol Hill, the celebrated system of checks and balances now looks more like bouncing cheques and absent balances. And come November, pundits have predicted that some incumbent congressmen may well find themselves bouncing higher than their cheques.

So the American mood in this election year is sour. The atmosphere is abrasive and the tone is pessimistic. As the worries and uncertainties intensify, Americans turn inwards.

What does that mean for us? Election politics and recession economics explain why we are living through the most difficult period in Canada-U.S. trade relationships for several years. The issues range from softwood lumber to automobiles and energy. Overall, vision and political management are being squeezed by narrow interests and short-term politics. In this environment, we have to use every instrument available to us to preserve, protect and promote our interests. We must push back and we are pushing back. We are determined to work with U.S. officials to find solutions to these problems. We continue to believe that the rights and obligations of the **Free Trade Agreement** (FTA) are our best defense against threats to our trade and our best offense for trade expansion.

3. Discrimination Under Free Trade

Last fall, for instance, we invoked our FTA rights in the debate on the National Energy legislation. We protested measures intended to discriminate against Canadian gas exports. We made clear that such provisions would be contrary to the Free Trade Agreement and we said so, early and often. At the start, the Government was even out in front of Canadian Gas Exporters Association in recognizing this potential threat. But it was the U.S. industry coalition among the customers of Canadian Gas that turned the tide on this issue. Canadian Energy interests realize that they had to make their product important to their U.S. buyers.

Our relationship with the U.S. is based on a vast network of agreements, treaties and legal underpinnings, each of which is critical to the whole relationship. The rights and obligations enshrining each agreement are too important to allow us the luxury of cherry-picking. We do not dilute one agreement to validate the other. We don't give away our rights under one to induce compliance with the obligations of the other. If you do so, you muddle not only your message, but far more importantly, you also jeopardize your national interests.

4. Issues of Concern

Turning to some issues of concern, the most important agreement for the energy industry is the FTA. Free trade means freedom to sell and freedom to buy; that is the basic bargain. When we negotiated the agreement, critics complained that it was nothing less than a plot by the Americans to steal our natural resources. This may have appealed to those who revel in the conspiracy theory of trade relations. The commercial reality is that prosperity cannot be built on resources left in the ground. If we are to insist on secure and stable rules for selling our products, our buyers are entitled to the same rules. The FTA enshrines this for energy. We expect no less, and we can offer no less, if we want to sell.

The FTA does not stop the California Public Utilities Commission (CPUC) from taking action to breach contracts any more than it prevented U.S. Customs from defining its own rule on North American content, but it does establish a framework to find a solution that respects mutual agreements and serves Canadian interests. We support Alberta, B. C. and the industry in their efforts to reach a negotiated settlement that will reduce regulatory intervention and allow the marketplace to work. And we are registering our concerns persistently in California and in Washington. We deplore the negative message that this kind of dispute sends. We are pleased that the Department of Energy and the State Department in Washington have recognized the importance of this issue and are working with Canadian representatives and the CPUC to reach a neutral resolution.

Threats can come from state legislators. We are devoting much attention these days to various bills introduced in New England and New York which run contrary to the text or the spirit of the FTA or which would impose U.S. environmental criteria on Canadian energy projects. We will continue to oppose strongly such bills by reminding U.S. legislators of their obligations under the Free Trade Act and that Canadian environmental reviews are as stringent and thorough as any in the U.S.

We are also following with great interest the negotiations related to the return to British Columbia of the benefits under the **Columbia River Treaty**. The Treaty has proved to be advantageous to both countries. It is a good example of how inter-regional cooperation on energy policy can increase efficiency and produce mutual benefits.

It is our hope that negotiations between the entities, B.C. Hydro on the Canadian side, and the Bonneville Power Administration and the U.S. Corps of Engineers on the U.S. side, will resolve issues relating to the return of the benefits. If however the entities are unable to resolve the issues themselves, then the Treaty provides for a dispute resolution mechanism and this may be employed to ensure that the objectives of the Treaty continue to be met. The Canadian government is strongly supportive of B.C. Hydro's position on this issue.

5. The Role of the Canadian Embassy in Washington

To allow me to better describe the role of the embassy in Washington, I would like to quote our previous Ambassador, Allen Gotleib:

"A Washington insider defined what it takes to be a successful diplomat here these days. He said a diplomat needs to be one part pundit, one part lobbyist and one part saloon keeper."

The exercise of political power in Washington is so extraordinarily complex that the only way one can understand or describe it is through a metaphor. And Mr. Gotleib went on to describe a stadium full of players, hundreds of them, thousands of them:

"Several teams take the field at a time, several kinds of games are in play at once. Players from one team occasionally play for another, without changing uniforms. There are no referees. If a diplomat is to do his job he must go out on the field and play the game himself."

As Gotleib put it, "The choices facing a diplomat are stark. Lobby on these issues and you may well be accused of interference in U.S. domestic affairs. Or don't lobby, and see your country's interests suffer."

I can assure that we will continue to go out on the field to protect and promote Canadian interest as much as we can. Thank you.

Ed Schreyer: This session is structured so that there will be time later for the panellists to answer your written questions. But we are now a few moments ahead of schedule, so perhaps we could entertain a question or two from the floor. Microphone One, please.

Question: I notice that your speech was entitled 'Energy Issues Between the U.S. and Canada,' yet the issues that you seem to be concerned with and have addressed were primarily worries about things that would prevent Canada from converting it's energy resources into cash quickly enough.

I would like to ask you if you consider energy issues from the Canadian perspective to also include whether or not Canada's ability to control its resources may also be an issue, and I'd like to particularly refer you to Article 904 of the Free Trade Agreement. I'd like to hear your point of view on whether or not Canada's interests will be adequately respected by this provision?

Guy Saint-Jacques: There were many critics when the Free Trade Agreement was negotiated. As I noted earlier, people were saying that it was a plot by the Americans to sell our resources, but the commercial reality is that prosperity cannot be built on resources left in the ground. Personally, I feel that the Free Trade Agreement provides a framework which ensures that there will be reliability, there will be stability and basically, as in the case of electricity, it is a matter for each Canadian province interested in doing that to decide what it wants to do with its electricity and I don't think that it's a sell-out of Canadian resources.

Our job in Washington is to make sure that there is a level playing field, that there are no attempts to discriminate against Canadian resources; and it is also to explain to people, in cases like electricity exports, that such exports or future exports won't take place if there has not been a total environmental review prior to the project receiving the green light.

Same Questioner: I ask you to respond to the question about Article 904 which basically says that once an export of an energy good has begun, it basically has to be continued on the basis of the experience of the last three years. I and a lot of other people see this as a way of locking in and keeping Canada from being able to turn the tap down or off, should it care to do so in the future. Could you respond please to the issue of Article 904?

Guy Saint-Jacques: I don't think that we are locked in by that article. Obviously the exchanges of energy are guided by contracts, so if an energy producer has reserves, sufficient reserves and if the regulatory agencies both at the provincial and at the federal level agree with the export, I don't see that as a sell-out, and I don't think that we are locking up our resources to American purchasers for longer than three years at most.

Ed Schreyer: Thank you very much, Guy.

Our next panellist is Mr. Lorne Seitz.

Lorne Seitz is the former President and Chief Executive Officer of the British Columbia Trade Development Corporation, the provincial government agency responsible for trade development. Earlier, he served as Deputy Minister of the International Business and Immigration for the Province of British Columbia and prior to that he served as Senior Vice-President of the Canadian Chamber of Commerce, responsible for the Chamber's international policies and programs. He holds degrees in economics and political science. Mr. Seitz.

Pacific Rim Trade – A B.C. Perspective

1. Introduction

Asian Pacific countries will continue to experience buoyant economic growth in the 1990s. While the OECD's Gross Domestic Product averaged growth of 3.2 per cent over the period 1987 to 1990, developing countries grew at a rate of 4.2 per cent. The countries of East Asia, along the western rim of the Pacific, led the way in growth.

Japan's growth will likely settle into a more modest pattern not dissimilar to that of other develcped countries. While it remains the major economic force in the region, other economies are assuming increasing importance. The economic feats of the so-called 'Tigers,' Hong Kong, Singapore, Korea and Taiwan, are well known. Over the 1970s and 1980s, these four economies, with average annual growth rates which have only recently settled below 10 per cent, have become major economic players in their own right and, while growth in the 1990s may be somewhat more modest than in the 1980s, the four will still grow at rates substantially higher than Japan and other developed countries.

There is yet another tier of developing countries which are about to take off. Malaysia, Thailand and Indonesia have been growing at around 10 per cent (GDP) since 1987. This dynamic growth will continue throughout this decade. And throughout the nineties and into the 21st century, a new group of Asian countries may well join their ranks, particularly the coastal provinces of China, Vietnam and the Philippines.

2. Energy Demand

The projected strong economic growth in the region – the sheer size of Japan's economy, the continued strong growth of the Tigers, the ascendency of ASEAN, and the emergence of several LDCs – will result in Asia Pacific leading the world in energy demand growth.

Projections by the Pacific Economic Cooperation Conference indicate total primary energy requirements for Asian Pacific countries will increase from about 1,400 million tonnes oil equivalent (MTOE) in 1988/90 to around 2,000 MTOE by the turn of the century. **Table 1** breaks this down by country. Projected growth rates will vary from 27 per cent for Japan to more than double that for Indonesia and Malaysia, and will average about 45 per cent for the region as a whole.

Table 1: Total Primary Energy Requirements in Selected Asia Pacific Countries*

	1988-90	2000	% Increase
China	675.1	993.0	47
Indonesia	38.1	86.3	125
Japan	429.6	544.0	27
Korea	92.6	138.8	50
Malaysia	17.8	41.9	133
Singapore	9.5	14.3	51
Taiwan	44.4	71.5	61
Thailand	25.8	48.2	85
Total	**1333.0**	**1938.0**	**45%**

* Million Tonnes Oil Equivalent.

Base years vary from 1988 to 1990

Source: Summary Report, Minerals and Energy Forum: Specialist Group Meeting on Energy Security Issues in the Pacific Region, July 23-25, 1991 Seoul, Korea (Pacific Economic Cooperation Region)

However, consumption patterns will undergo substantial changes. These changes will come about as developing countries assume a larger role in the economy of the region, as economic activity diversifies from its traditional agrarian base, as energy-intensive industrialization strategies are pursued, as living standards rise and as demographic factors such as population growth and increasing urbanization occur. In particular, demand for commercial fuels in the transport and electricity sectors is expected to grow rapidly. Aggregate demand for petroleum products in developing countries is expected to rise, particularly in applications where there are no ready substitutes, such as the transport sector and in rural areas. Electricity capacity is expected to expand rapidly with implications for consumption of coal, natural gas and uranium and for hydro generation. **Table 2** describes these changes in more detail.

The large increase in energy demand will require major development in the region's capacity to produce, transport and utilize energy resources. Adequate investment, technology and resource flows will be required to undertake this development.

Table 2: Total Primary Energy Requirements by Type for Selected Asia Pacific Countries*

1988-1990

	Oil	Coal	Gas	Nuclear	Hydro	Total
China	114	515	14	—	32	675
Indonesia	26	3	8	—	2	39
Japan	244	74	46	44	21	429
Korea	50	24	3	13	2	92
Malaysia	11	1	5	—	1	18
Singapore	10	—	—	—	—	10
Taiwan	24	11	1	6	2	44
Thailand	17	3	5	—	1	26
Total	**496**	**631**	**82**	**63**	**61**	**1333**
% of Total	37%	47%	6%	5%	5%	100%

2000

	Oil	Coal	Gas	Nuclear	Hydro	Total
China	201	702	27	—	64	994
Indonesia	50	10	16	—	10	86
Japan	277	88	66	79	34	544
Korea	66	40	8	21	4	139
Malaysia	17	4	17	—	4	42
Singapore	14	—	—	—	—	14
Taiwan	29	24	6	10	2	71
Thailand	20	12	13	—	3	48
Total	**674**	**880**	**153**	**110**	**121**	**1938**
% of Total	35%	456%	8%	6%	6%	100%
Growth	36%	39%	87%	76%	98%	45%

* Million Tonnes Oil Equivalent.

Source: Summary Report, Minerals and Energy Forum: Specialist Group Meeting on Energy Security Issues in the Pacific Region, July 23-25, 1991 Seoul, Korea (Pacific Economic Cooperation Region)

On a country-by-country basis, energy demand and fuel type will vary during the 90s. **China** will continue to be the largest energy consumer with growth of approximately 47 per cent and aggregate demand reaching nearly 1000 MTOE. Coal will remain the dominant fuel, although its share of total consumption will decline from 76.3 to 70.7 per cent. Oil, hydro and natural gas will assume increasingly larger roles.

Indonesia's total energy requirement will increase by 125 per cent from 38.1 MTOE to 86.3 MTOE. Hydro's percentage of total demand is expected to grow from 4.7 per cent to 11.6 per cent while coal will increase from 6.6 per cent to 11.6 per cent. Oil will grow in the aggregate, but will fall from 68 to 58.3 per cent of total demand.

Japan's total energy consumption will grow 27 per cent from 429.6 MTOE in 1990 to 544 MTOE in 2000. The share of nuclear energy will grow from 10.2 to 14.5 per cent, largely displacing oil. Hydro and gas will also increase their share while coal will decline slightly.

Total energy requirements in **Korea** will grow by 50 per cent from 92.6 MTOE to 138.8 MTOE. Fuel type will shift somewhat from oil to coal and natural gas with nuclear power continuing to hold a 15 per cent share.

Malaysia will likely experience the largest increase in energy consumption with a projected growth of 133 per cent. However, aggregate demand will still be relatively modest, reaching 41.9 MTOE from 17.8 MTOE in 1989. A large shift from oil to natural gas will take place along with modest increases in the shares of coal and hydro.

Singapore energy demand will grow by 51 per cent from 9.5 MTOE to 14.3 MTOE. Oil will continue to be virtually the sole type of fuel.

Taiwan will continue to lead the Tigers in growth of energy consumption with an increase from 44.4 MTOE to 71.5 MTOE or 60 per cent. Oil's share will fall from 54.5 per cent to 40.7 per cent, largely replaced by coal (from 25.0 per cent to 34.0 per cent) and gas (from 2.9 per cent to 8.5 per cent). Nuclear and hydro will remain at about 14 per cent and 3 per cent, respectively.

Thailand has been experiencing phenomenal growth in the past decade and that growth will continue in the 1990s with energy consumption reaching 48.2 MTOE (from 25.8 MTOE), an increase of 85 per cent. A significant shift in fuel type from oil to coal and gas will accompany this aggregate growth.

Overall, oil and coal will remain the dominant fuel types by 2000, meeting 35 per cent and 45 per cent respectively of the total primary energy requirement for the major Asian Pacific economies. However, their growth will be significantly less than natural gas which will grow 87 per cent from 82 to 153 MTOE, nuclear at 76 per cent (from 63 to 110 MTOE) and hydro, doubling from 61 to 121 MTOE.

3. Energy Supply

While the region possesses significant reserves of a range of fuel types, it remains heavily reliant on imports. In spite of expanded production in Indonesia and China, the Middle East is still the primary source of petroleum for Asia Pacific countries and will likely continue in that role by the end of the decade.

China and Indonesia possess significant coal reserves but will not be able to quickly develop the capacity to export large quantities. The major suppliers of thermal coal to the region are, and will likely continue to be, Australia, the U.S. and South Africa.

Natural gas supplies are largely sourced from within the region with Indonesia, Malaysia and Brunei providing the majority of gas for intra-regional trade. The future for regional production of natural gas looks bright as these countries are joined by Australia as prime sources of supply. Other sources are Papua New Guinea and perhaps Sakhalin Island.

4. Energy Issues for the 90s in the Asia – Pacific Region

A number of common energy issues face most of the countries of the region. They include security of supply, diversification of the supply mix and sources of primary energy, energy conservation, capital requirements for new energy projects or infrastructure development, environmental issues and human resource development.

There are two general targets which are being pursued in relation to fuel switching. One is 'wean from oil' and the second is 'wean from hydrocarbons.' Events in the Gulf have focused attention once again in the Asia Pacific region on the issue of energy security. Despite new discoveries, the availability of crude oil to energy importers from Asia Pacific producers is shrinking. As a consequence, after years of decreasing reliance on the Middle East, the region faces the prospect of rapid increases in imports from the Middle East in the 1990s. Attention will therefore focus to strategies for redirection of energy sources, both in terms of their fuel mix and sources of supply.

The issue tends not to be the behaviour of OPEC, but the possibility of supply disruption because of geopolitical risks associated with oil. Pacific economies have therefore tried to switch to alternative fuels which are found in areas where geopolitical risks are lower, or can be developed domestically, such as coal, natural gas, nuclear and hydroelectric power.

Coal holds good potential, particularly for electricity generation since the region possesses large coal reserves, and sources of supply are available in areas where geopolitical risk is low. However, lower grades of coal and older technologies for burning coal pose environmental problems while fuel substitution possibilities into coal are constrained in some Pacific economies by the unavailability of the necessary infrastructure.

Many Pacific economies are planning to switch to gas because of its abundance in the region and its clean burning qualities. However, gas projects, whether as liquefied natural gas (LNG) or pipelined natural gas, require large capital costs and a long time-frame. An alternative to LNG is the development of regional reserves for a trans-ASEAN natural gas pipeline, possibly leading to a Southeast Asian grid, drawing in the gas reserves in Indochina as well. A pipeline could also supply natural gas from the Russian Far East to Korea. Gas to Taiwan and Japan would, however, require LNG capacity.

Nuclear power has become an important source of energy in Japan, Korea and Taiwan; each plans to expand their nuclear capacity by 60 to 75 per cent during the decade. The main issue will be the selection of sites.

Hydroelectric power is expected to double in the next ten years with much of the growth taking place in China and Indonesia. Other ASEAN countries and Vietnam are also planning hydroelectric projects. In addition, the Russian Far East, in the long term, might become a source of electricity exports to China and Korea.

Energy-saving technologies will form an important part of the energy strategies of these countries. There is substantial scope for energy conservation. Improvements in efficiency of energy production and in the manufacturing, commercial and residential sectors are being pursued. Fuel switching in transportation will depend on the introduction of mass transit systems and on large scale switching to alternatives for motor vehicles like petroleum gas (LPG), natural gas (LNG) and methanol. A major policy instrument to achieve energy conservation and fuel switching is an efficient pricing policy.

Environmental issues will assume an increasingly important position in energy project decisions and plans in Asia Pacific as they do elsewhere. Emissions are a global issue as well as one which impacts local communities and will pose a challenge to expansion of coal-fired electricity generation. Investment in new technologies and the use of low sulphur coal might reduce environmental impacts, but costs would increase and domestic coal reserves might not be suitable.

Siting issues will continue to pose some limits to development of nuclear and hydroelectric capacity. Similarly, expansion of nuclear power will attract widespread concerns over waste disposal and safety.

The capital required to finance the broad range of energy and energy related projects (electric power generation, gas pipelines or LNG infrastructure, coal ports, rail capacity to transport coal) will place enormous pressure on domestic capital sources. This issue will be particularly significant for developing countries such as ASEAN, Indochina and China. The magnitude of projects in those countries will stretch the funding capacity of national governments and the multilateral agencies.

Transfers from high income to low income economies in terms of aid flows are familiar. However, the emergence of concern over the greenhouse problem and other waste management issues may well cause development aid flows to be directed toward addressing environmental costs associated with projects rather than financing the core project itself. If such is the case, where will financing be found for the large energy projects which are required?

It appears private capital will play an increasingly important role in energy projects in Asia Pacific. As a result, various sorts of build/operate/and transfer schemes (BOTs, BOOs, and BTs) will be pursued. Market-oriented domestic pricing policies for energy will become necessary.

Strategies for fuel-switching and energy conservation will depend heavily on access to new technology and therefore on the skills of the work force in the adoption and operation of those technologies. Three levels of skills are relevant. The first is specialized training in the use of equipment or techniques. The second is up-grading of skills of professionals in the energy sector. The third is skills required of industry planners and those working in the research sectors. While the first can be addressed by the enterprise itself, the latter two would benefit from the international transfer of skills through the movement of either students or training staff.

5. Opportunities for Western Canada

The demand projections and the issues which have been raised suggest a number of trade opportunities for Western Canada.

For at least the remainder of this decade, coal will likely be the replacement fuel for oil, particularly for electricity generation. Canada has not made any significant dent in the Asian markets for steaming coal since our costs tend to be higher than from competitors in South Africa, Australia and the U.S. However, depending upon future pricing, particularly if demand increases significantly, and current sources of supply cannot keep pace, opportunities may arise.

Electricity generation projects will provide excellent opportunities for the next two decades. The engineering and equipment capabilities of Western Canadian firms position them to successfully pursue a number of these projects alone or, more likely, as part of larger consortia. Most of the countries of the region will be expanding their coal-fired electrical generation capacity. New hydroelectric generation projects will likely be a significant element of the energy strategies of China, Indonesia and Indochina.

While Western Canadian firms have not played a major role in the nuclear field, expansion of nuclear power generation should offer opportunities to Saskatchewan uranium producers.

The development of infrastructure will offer numerous opportunities for Western Canadian firms. Expansion of electrical generation capacity based on coal requires the development of new and expanded coal ports. Similarly, plans to expand coal production in ASEAN and China require enhanced rail capacity and specialized rail systems. Western Canadian firms are well positioned to compete for these projects.

Similarly, Western Canadian pipeline construction and operating companies will find opportunities in the major expansion of natural gas usage which is projected for the region. Likewise, the rapid growth in the demand for electricity will bring with it an equal need for new, expanded transmission capacity.

The major challenge Western Canadian firms must overcome if they wish to successfully compete for large infrastructure and electricity generation projects is identifying financing. As indicated earlier, most of the developing countries of the region (ASEAN, China and Indochina) do not have the capital resources to finance projects of the scope they require. Furthermore, financing from international agencies such as the Asian Development Bank, the World Bank and national development aid bodies will fall far short of what is required. Successful project proponents will be not only those with the technical and managerial skills to complete the project, but also the ability to finance and possibly operate the facility when completed. This financing need has led to the popularity of the build/operate/transfer concept. The extent to which Western Canadian companies can meet this larger need will determine their potential for success in capturing a share of the numerous opportunities which exist in Asia Pacific.

Aside from the large 'hard' infrastructure projects, there are a number of opportunities to provide 'soft' infrastructure to meet the regional energy demands.

Energy efficiency will be a significant element of the energy strategies of Asia Pacific countries. This will involve technology and equipment to improve efficiency in generation, transmission and usage of energy.

A major challenge for all countries, developed and developing, is to reduce the harmful effects of production and use of energy. Reducing emissions, addressing siting problems and disposal of wastes will all be key considerations in every country's energy strategy.

Lastly, human resource development must be an integral part of the energy strategies of Asia Pacific countries. Developing the technical skills to undertake projects and operate the facilities to meet the greatly expanded energy needs will require a major investment in education and training. This will provide opportunities for Western Canadian education institutions to train students from these countries in Canada, or to provide educators and administrators to develop and deliver training programs within the country. Similarly, companies will have opportunities to undertake technical training programs for energy firms and government organizations in a number of countries.

6. Summary and Conclusions

The buoyant economic expansion of Asia Pacific countries will create a demand for energy in the 1990s and into the next century which will be unmatched in the world. Projections by the Pacific Economic Cooperation Committee indicate that primary energy requirements will increase by 45 per cent by the year 2000.

The region must, however, address a number of issues in attempting to meet that demand. The increasing demand for oil raises security concerns which will lead to major efforts to diversify sources of supply and fuel types. Energy conservation is becoming an issue in all Asian countries as are environmental concerns.

The capital requirements to meet the increased capacity which must be developed cannot be met from domestic sources or from international development agencies. As a result, new mechanisms for financing and ownership of these projects are evolving as exemplified by the build/operate/transfer (BOT) concepts which are becoming quite popular.

Numerous opportunities exist for Western Canada in the expansion of energy capacity in Asia Pacific. The opportunities in which Western Canada has the greatest chance of success are in the development of electricity generating capacity, particularly hydroelectric projects, 'hard' infrastructure development (coal ports, railway expansion, natural gas pipelines and electricity transmission) and 'soft' infrastructure enhancement such as in energy efficiency, environmental management and human resource development.

Mr. Chairman, thank you very much.

Ed Schreyer: Thank you, Lorne.

I would now like to introduce our final panellist this morning, Mr. Gary Fuqua, who is Assistant Administrator in the Office of Energy Resources at the Bonneville Power Administration in Portland, Oregon.

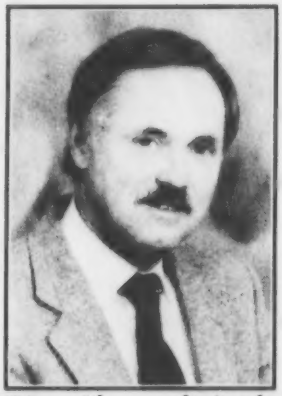
He has had a long and distinguished career. I shall only refer to recent years and his more recent senior appointments. His present work and responsibilities involve resource planning, conservation, and generation acquisition programs for Bonneville Power, oversight of nuclear generating facilities, and responsibility for certain aspects of the administration, the Columbia River Treaty, and for economic analysis of transmission intertie alternatives.

I notice that way back in the 1970s, Gary was Regional Economist with the U.S. Army Corps of Engineers. I mention that, really taking a bit of personal liberty, because I am one of those who's been curious for a very long time as to the differences in administrative responsibility between the U.S. Army Corps of Engineers on the one hand and the Bureau of Reclamation on the other.

Gary, please give us the benefit of your views on west coast electricity trade.

West Coast Electricity Trade

Thank you, Mr. Chairman, and thank you for the invitation to come to British Columbia to talk about west coast electricity trade. Sue Hickey sends her regrets that she was unable to come today. So it's my pleasure to present her paper to this Forum.



In the next ten minutes or so, I'd like to basically give you some quick background and some ideas on our views on electricity trade on the West Coast.

1. Introduction

Major electric energy trade on the West Coast has a history dating back to the 1960s, with construction of the Columbia River Treaty Projects and the transmission inter-ties to California. The key components of that trade have been marketing of products that matched the diversity of needs among the regions, attractive prices that have favoured economic arrangements, and access to markets using the extensive interconnected transmission system on the West Coast. Integration of the environment into transactions and resulting environmental benefits is a newly highlighted key element, which adds a new dimension to the West Coast trade equation.

My comments today address these three components, and tie them to the impacts the environment will have on trade. In this new reality, we need to use demand-side resources, and our existing generation and transmission system on the West Coast to foster efficient, beneficial trade for mutual benefit. I will conclude my remarks by exploring some ideas on how the Bonneville Power Administration (BPA) believes that more beneficial trade can occur.

2. Products, Future Changes, Prices and Access to Markets

2.1 Major Electricity Products

Most of you are familiar with the basic products of an electric system, but let me just summarize them briefly.

Energy

This is the basic electric service that is provided on a continuous basis. Energy is the limiting product in a hydro system where water is the fuel and the generating capacity is much greater than the ability of fuel to provide sustained energy deliveries. Because both British Columbia and the Northwest have hydro systems, they are energy-limited systems. The Southwest and Alberta, however, are primarily thermal systems which have the ability to deliver energy on a sustained basis by burning fuel up to the capacity of the units.

Capacity

This is the other key product of a generation system. For a hydro system with significant amounts of excess capacity or ability to provide peak power over high-use hours of the day, this becomes an important product that has market value for other systems. Thermal systems tend to be capacity-limited and, therefore, offer a market for peaking from hydro systems.

Non-Firm Energy

This is another abundant product of a hydro system which is available in most years. For the Northwest and British Columbia, non-firm or secondary interruptible energy is available in all but the lowest streamflow years. It is very valuable in displacing the operation of more expensive thermal plants. Non-firm energy is a valuable product whenever it is available, for both the Northwest and California, to reduce energy costs and improve air quality by allowing thermal plants to be shut down.

Exchanges and Storage

Energy and capacity exchanges and storage in hydro systems are products that enhance the flexibility of diverse power systems. The diversity of peak seasons between Canada and the Northwest, and California, allows the trading of valuable products. In addition, the diversity between thermal systems (capacity-limited) and hydro systems (energy-limited) adds to the value. As a result, seasonal diversity and generation diversity create trade opportunities of value to both systems.

Storage is another product that hydro systems have that allows for delivery of power on a controlled schedule, as opposed to when the natural flows occur. Storage is a valuable asset in hydro systems, and provides the ability to store and release water at the times of highest demand and value.

Transmission Service

An interconnected transmission system as now exists on the West Coast allows individual regional systems to enter into transactions that can take advantage of seasonal and generation diversity and storage. Transmission, and the services it can provide, is the link that enables economic trade for mutual benefit to occur.

2.2 Changes in Markets and Products

During the last two or three years, significant changes have occurred in West Coast electricity markets and products. These changes will continue as we move through the 1990s.

Energy

The ten-year energy surplus that the Northwest had is now gone. In 1992, BPA will be energy-deficit by 400 average megawatts (aMW), the projected deficit will rise to 800 aMW under medium-low growth or 1,500 aMW under medium-high load growth by the year 2000. BPA and other Northwest utilities are now net buyers of

energy and will continue to be over our ten-year planning horizon. Our first choice for meeting these deficits is to purchase 600 aMW of conservation, and to use the existing system with efficiency improvements and trade with other systems to meet load growth.

Capacity

BPA has sold most of its surplus capacity. We are now assessing our capacity situation, but probably will not have large amounts to sell on a yearly basis. Capacity surplus will probably increase in spring and possibly early summer because of releases of water to assist migration of salmon as a result of listings under the Endangered Species Act. There may be some summer capacity available following this assessment. We are evaluating the amount and need for capacity in the Northwest, as well as in Canada and California, to determine the possible opportunity for exchanges.

Non-Firm Energy

Non-firm energy has always been a valuable product of the B.C. Hydro and BPA hydro systems. The picture is changing here as well. The recovery plans under the Endangered Species Act will impact the timing of non-firm energy from the Pacific Northwest. In addition, there have been debates in California about the source of economy energy (hydro or thermal) from other regions, and the desirability of these products from an environmental standpoint. If California decides that economy energy from the Northwest is not favoured, it will improve the economics of using non-firm energy internal to our system in combination with combustion turbines (CTs) to generate firm energy from the CTs and displace these thermal units at every opportunity with non-firm.

Exchanges

Exchanges are a significant opportunity for the Northwest, British Columbia, Alberta, and California. The seasonal peak needs for California are in the summer. For the Northwest and British Columbia, the peak power needs are in the winter. Moreover, the hydro systems in the Northwest and British Columbia are a complementary match with the thermal systems in Alberta and California. Exchanges of capacity for energy during peak season needs of the respective systems allows for the efficient use of existing generation and transmission assets. This is an opportunity that can produce a win-win-win situation for Canada, the Northwest, and California. For example, British Columbia and the Northwest can exchange summer capacity with California for winter energy. All three regions gain without additional capital investments.

2.3 Prices

Predominantly hydroelectric systems, such as in the Northwest and British Columbia, are not peak-deficient but rather are energy-deficient. For such systems, the marginal energy source has become combustion turbines fuelled by natural gas, or cogeneration projects which use steam, fuelled by gas, in a manufacturing process and, as an additional product, can generate electricity for sale to utilities. These resources now have a real levelized cost of about 3 to 3.5 cents per kilowatt-hour in 1991 U.S. dollars.

There appears to be a significant supply of resources at this price, as evidenced by BPA's recent competitive bid, in which we received offers for over 4,000 MW from gas turbines or gas cogeneration, possibly because of the current surplus gas situation. Relatively low gas prices suggest that the next several years are an opportune time to enter into arrangements because of the competitive cost of gas-fuelled resources. The current market also suggests that it would be timely to enter into capacity for energy exchanges when gas prices are favourable. In this environment, the exchange rates of capacity for energy will be more favourable because generation of the energy with gas will be at a lower cost.

2.4 Access to Markets

BPA owns 80 per cent of the transmission lines in the Pacific Northwest. We have been the key provider of transmission between British Columbia and markets in California and the Northwest. At the present time, legislation is pending in the U.S. House of Representatives which would grant authority to the Federal Energy Regulatory Commission (FERC) to order U.S. utilities, including the Bonneville Power Administration, to provide transmission services to other utilities and non-utility generators. The recent expansion of non-utility generation is a major force behind this legislative initiative. If this legislation is enacted, we expect that U.S. transmission owners, as well as applicants for service, will have a significant incentive to find voluntary, mutually beneficial transmission arrangements rather than rely on the uncertain FERC process. We at Bonneville view the purpose of this legislation as being fully consistent with our goals of West Coast cooperation through coordination of generation and transmission facilities for mutual environmental and economic benefit.

2.5 Summary

Each of the regions on the West Coast have needs for specific electric energy products.

Surpluses are gone and the markets are tightening. Fortunately, because of the opportunity to more effectively use the existing systems, the efficiencies of combustion turbines, and the amount and price of gas, we see the next few years as a 'buyer's market.' The prices of resources are competitive at this time.

The key opportunities are for exchanges and storage arrangements, and other niche areas that fit the needs of individual utilities.

3. Environment

The use of our existing generation and transmission systems in a more effective manner is a natural fit

with an increased awareness and need to protect our environment. During the 1990s, the environment will be a key driver on the West Coast with environmentally-aware citizens exhibiting a deep interest in stewardship of water, land, and air resources. This attitude will shape the West's energy system over the next decade. Three of the most important environmental issues are electromagnetic fields (EMF) and transmission line development, concerns about wild salmon and steelhead (Endangered Species Act) effects on operation of the hydro system in the Northwest, and air quality in major metropolitan areas. We also need to gain a better understanding of the environmental benefits and costs of West Coast transactions on the environment in Canada. This will help us structure future arrangements that take advantage of environmental benefits.

EMF - We do not yet have good scientific information on effects of electromagnetic fields. Research will help answer questions about the effect of the magnetic field surrounding high voltage transmission lines on people. Despite the current lack of good data on EMF, the issue is in the public arena and will be an issue that has to be addressed with most new transmission line construction.

Endangered Species Act and Salmon - If you have been following this issue over the last year, you know that the listing of Snake and Columbia River wild salmon under the Endangered Species Act has been a continuing front-page issue in the Northwest. One species has been listed as endangered, and we expect that other listings of salmon as threatened or endangered is likely to follow. The recovery plans to increase the population of wild salmon will impact all the uses of the Columbia River, including the generation of electricity. We are currently assessing the probable impact on power. Our current estimates range from an 80 to 400 aMW impact on firm energy from the hydro system. There will be impacts on capacity as well. Depending on the final outcome of proposed draw-down of the Snake projects to speed flows through the system, the capacity reduction could be significant. As was noted earlier, with more releases of water in the spring, there will be an increase in the amount of non-firm energy and capacity during the spring and possibly summer months, providing an opportunity for exchanges.

Air Quality - Air quality in metropolitan areas will remain a high profile issue. This will impact siting of new resources in air sheds with high concentrations of emissions from automobiles, power plants, and manufacturing processes. It has also resulted in legislation in California which requires an increasing percentage of vehicles in California to have zero emissions beginning in the late 1990s. As a result, California will continue to have a need for new resources to serve growing loads, including electric vehicles, but will have less and less ability to develop resources in those air sheds to serve those loads. In addition, metropolitan areas in the Northwest and British Columbia will see an increasing focus on air quality as population levels increase.

4. Environmental Impacts

BPA now considers environmental impacts, including those occurring indirectly in interconnected systems, in making all of its resource decisions. We believe this effort is a critical variable in assessing business risk and public acceptability when purchasing new resources. We are working with other utilities to advance measurement techniques in our efforts to internalize resource decision costs on the environment.

5. Summary

With this background on products and prices, transmission, and environmental issues, some basic principles for enhanced trade emerge:

Collaboration on Conservation/Demand-Side – All of the West Coast utilities place a high priority on development of demand-side resources. Together we are a substantial market force for new efficiency products. Collaboration can greatly enhance our efforts.

Efficiency as a Resource – Using the existing transmission and generation systems in a more efficient manner produces benefits from both a cost and an environmental perspective. This should be a principle in all transactions involving utilities in every regions.

Niche Markets – Utilities have opportunities available to use exchanges and storage to fill niches in product needs and sales. The complementarity between utilities and systems will define these opportunities.

The Broad Perspective – Think broadly about mutual benefits. Make the pie bigger by exploring arrangements that involve more multiple parties. This creates an environment that goes beyond win-lose. For example, how can British Columbia with its winter peaks, storage potential and resource base, the Northwest with its winter peaks, non-firm energy and transmission system, and California with summer peaks and thermal system, reach agreements that are cost effective and are a better alternative for the environment than constructing new resources?

Joint Ventures – Most utilities cannot afford, from an environmental or a cost-effective standpoint, to go it alone any more. Public awareness, environmental concerns and cost factors should lead utilities to conclude that they will be more successful in meeting future power needs through joint ventures with others, as opposed to single-purpose resource development or power transactions that they attempt to implement on their own.

Thank you, Mr. Chairman.

Ed Schreyer: Thank you, Gary.

We are now ready for questions. The first one is addressed to Gary Fuqua, and reads as follows: "What is going to happen to the Washington Power Planning Supply and Service nuclear sites? Will they be re-powered, presumably with natural gas, or will they be reassigned or re-dedicated, etc.?"

Gary Fuqua: One of the Washington Public Power Supply System plants is now operating. That is Plant Number 2, at Richland. There are two other plants, one down at Satsop which is on the coast in Washington, and one also in the Richland area that are in what we describe as a 'mothball' state. These plants are about three-quarters and about two-thirds complete, respectively.

Based on our current assessment of the availability of demand-side resources, as well as the opportunities with exchanges and with gas-fired cogeneration, we don't see either of those plants in our resource picture in the near future, and they probably won't be needed until after the turn of the century, if at all.

Ed Schreyer: I suppose this next question would be closely related as well. "In addition to gas-fired cogeneration or combined cycle generation, is Bonneville using its influence to promote fuel substitution, electricity to gas, for space- and water-heating, for example? What per cent, if any, in your demand-side savings does substitution represent?"

Gary Fuqua: With regard to fuel switching, our present demand-side program includes no fuel-switching programs. That issue has been in front of us for the last year or two, and we've had a lot of debate in the Pacific Northwest about what Bonneville's role should be. We've basically said go ahead and do it, to any utility that chooses to implement a program on fuel-switching.

We are not in a position at this point to financially support fuel- switching. We have some of our customers who object strongly to Bonneville being involved in basically subsidizing fuel-switching and some customers who would support it; at this point, our current policy is to basically sit on the sidelines and have a debate with people about it but allow our customers to make the decision with regard to individually whether they want to implement a fuel-switching program.

Ed Schreyer: This question is also posed to Gary and it reads as follows: "Where will Bonneville Power, BPA, obtain the energy and capacity for returning the Columbia River Treaty downstream benefits to British Columbia in 1998?

Gary Fuqua: In our planning studies over the last ten years, we've assumed that the Canadian entitlement will go back to Canada. We have planned on that. Over this period of time, our resource plans include basically a substitute for that block of energy. Currently, the substitutes are expected to be resources located in the United States: demand-side resources, exchanges and any new resources we develop through our competitive bidding process. There is now discussion with British Columbia about what the province wants to do with the Canadian entitlement, but until we hear otherwise from the government and the citizens of British Columbia, we intend to return the entitlement as prescribed in the Columbia River Treaty. It is an American obligation.

Ed Schreyer: These next two questions are directed to Guy Saint-Jacques and Lorne Seitz: "Please comment on the projected impact of the North American Free Trade Agreement (NAFTA), regarding the ability of Mexico and countries in Central America to supply oil-fired and nuclear energy."

Guy Saint-Jacques: The energy chapter of NAFTA is still being discussed, and I must say that the negotiators have been very good at keeping their talks a secret. But I am aware of a study that was made by Energy, Mines, and Resources which was published a few months ago which concluded that there could be gas flowing from Mexico to the United States, in maybe ten or fifteen years.

Concerning nuclear power, I would be surprised if there would be much electricity generated by nuclear power plants in Mexico which could come north.

Ed Schreyer: The major new dimension then in NAFTA would be Mexico's highly vaunted oil and gas reserves; isn't that the basic impact on energy matters?

Guy Saint-Jacques: There are two aspects to this. One is the possible investment by Canadian and American companies in the Mexican energy sector. That could present many advantages in terms of efficiency, and better use of resources in Mexico. There's another aspect, which is related to sending gas to Mexico to displace coal-fired generation. There are already some projects being discussed to replace a coal-fired plant in Mexico by gas which would be flowing from the United States and even from Canada.

I am aware of one project which involves a combination of Canadian and American gas and I think we should expect that there will be more of these projects announced. Mexico will become more sensitized to environmental questions and as a result we should expect to see gas-fired plants replacing coal-fired plants.

Ed Schreyer: Could you just elaborate on that a little further to enlighten us as to how there might be some practical prospect of Canadian and U.S. gas entry into Mexico, given that they have gas reserves of their own and moreover, 'associated' gas. This is gas produced in association with oil field production, where they have been facing problems of flaring off gas, or re-injection, etc. Given that, how do we face a scenario in

which there is serious practical prospect of the entry of Canadian or U.S. gas into that incipient market?

Guy Saint-Jacques: There are two stages. Initially, the gas fields in Mexico have to be developed and this will require lots of capital and also the infrastructure is not there. In the short-term, there is lots of gas available in the U.S. and in Canada and the infrastructure could be built relatively inexpensively; it would just be a matter of extending existing pipelines across the border.

Because the markets are right across the border, we would expect normally that this would be done. Over the longer term, if it becomes easier for foreigners to invest in Mexico, then we should expect more natural gas production there and then if the infrastructure is developed, maybe it could flow in the reverse direction.

Question: Mr. Chairman, if you are looking for a short-term practical reason why Mexico has a policy of exporting all the oil it can to the United States at $5 a million BTUs, it's because they can import gas from the U.S. at $2 a million BTUs, and gain $3 million dollars per million BTUs in the process, which is worth pursuing.

Ed Schreyer: There is still a problem of associated gas in the production of all those millions of barrels of oil, which they are going to have to flare off.

Loren Seitz: One should sometimes be careful about looking at agreements like NAFTA as the driving force behind some of these things. Rather, it may be economic and commercial forces that will drive some of the energy sector developments well beyond anything that might take place with respect to a trade agreement.

Carolyn Linden: My name is Carolyn Linden and I am from the Nechako Environmental Coalition in Prince George. I have been hearing a lot in the last couple of days, in fact, in the last couple of weeks, about energy exchange and trade and I'm confused here because when you exchange or when you trade you give something and you get something. From what I'm hearing it seems to me that we are giving. I know what B.C.'s people have already given up in terms of dammed rivers. We have power, we have energy and the same thing applies to Canada as a whole.

But I would like to know what we are getting, besides maybe a few bucks for a few people. I am talking about our society as a whole. What are we getting from this so-called exchange and trade? I'd like to hear from all the panel members because they obviously have very different perspectives, but first of all I'd like to hear from our federal representative in Washington please, because I think he must have the broadest perspective.

Guy Saint-Jacques: I think that energy exchanges apply mainly to electricity trade and that if we look at the figure for B.C., I think B.C. exported $120 million worth of electricity in 1991, and, as Mr. Fuqua explained, I think this should be pursued a lot more because the systems are complementary. This money flows to B.C. Hydro, a Crown Corporation wholly owned by the people of British Columbia, who in turn pays it to Victoria as taxes or dividends. That's about $60 per person to help pay for education and medicare, etc. Is that a few bucks for a few people?

If you look at other forms of energy, like gas and oil, it's obvious that we are exporting more than we are importing from the U.S.

Coal is one of the few exceptions in the energy sector where the U.S. is exporting more to Canada. That is for obvious geographical reasons. It's a question of where the mines and the railroads are located in that case. Transportation costs are very important.

Your question comes back to the one that I had earlier about the benefits, the overall benefits for Canada. We think that Canada benefits a lot from these sales of energy products. Of course, we would like to benefit a lot more and that is why we would hope that the price of gas would be higher but again, that's driven by the market.

Loren Seitz: I think that with respect to Asia Pacific, the opportunities that I see in the short- and medium-term do not really involve the export of an energy product itself. It basically involves the export of expertise of engineering services, of technology, of some equipment. And that basically, is just a clear win. We are virtually giving up nothing in the sense of our society or our environment or anything of that nature.

Over the longer term, there may be some potential with respect to thermal coal, steaming coal, and natural gas in terms of LNG, but as I indicated, there are some major commercial issues with respect to that and at the moment in the short- and medium-term, I don't think we are competitive in terms of exporting to Asia Pacific.

Gary Fuqua: With regard to your hydroelectric system, the water flows through the system primarily in the spring and the peak needs come in the winter; if you can sell that product to somebody who needs it during the summer period and basically trade to get something back in the winter when it has more value to you, then that is the basis for meeting your growing load without incurring the cost of additional generation.

David Scott: I have a question for Mr. Fuqua. In your talk, I understood you to say that the trade between the province and Pacific Northwest should be for mutual benefit and it should be a win-win situation. Of course, I think we can all agree on that, that's the principle of trade.

With regard to the disposition of the downstream benefits or the Canadian entitlement as you call it, I

understand there's a proposal afoot for a generation plant to be built in British Columbia by Bonneville Power or at least by American agencies in order to compensate Canada for the downstream benefits which would then, in that case, stay in the Pacific Northwest.

If that's the case, I wonder if you could explain how putting a polluting source, granted a fairly clean polluting source, in British Columbia, in return for a hydro generation source which, after all, involves no additional environmental damage because it would be existing structures that produce it. How does that end up being a win-win situation?

Gary Fuqua: I made some comments in Vancouver a couple of months ago and what wasn't clarified was that we were discussing some alternatives for returning the downstream benefits. That proposal was among them. It is not a formal proposal on the part of Bonneville Power Administration or by anyone in the United States.

We did have discussions with the government in regard to possible alternatives. Among them was a combustion turbine but so was conservation. In other words, sending dollars up here for you to run conservation programs, basically sending dollars up here to save having to build additional units at hydro projects. Those were simply some of the alternatives. Another was perhaps selling some of the downstream benefits and keeping some of it. But at this point, we were simply saying, here are some ideas that you might wish to consider.

It was not a proposal and our plan at this point is to deliver all of that power back, beginning in 1998 when it's due, and ramping up to the full amount in 2003, unless government and citizens of British Columbia decide on some other alternative.

Jim DiPeso: This is for Gary Fuqua. I am Jim DiPeso from the Northwest Conservation Coalition. Ted Halleck, the chairman of the Power Planning Council in the northwest, has called gas 'a beguiling temptress.' What we are concerned about is that with Bonneville moving forward with the development of gas-fired generation, is conservation going to get the short end of the stick in the acquisition of resources that you will need?

Gary Fuqua: Our first choice is demand-side resources and we are going as hard and fast as we can in the Northwest, working not only with the utilities but also restructuring Bonneville internally to deal with this. Our area offices are much more involved in working with utilities. We intend to spend upwards of 2 billion dollars doing demand-side work. Gas turbines aren't a substitute for conservation. If you look at the environmental merit order of these resources, conservation demand-side is first, improving efficiencies of existing systems is second and some form of renewable is third. If it's used with wood waste, for example, gas tends to be a renewable in a co-generation sense.

There is an environmental hierarchy and an economic one and we think , number one, that the cheapest approach, the least costly is conservation demand-side and system efficiencies and then you go up from there.

Ed Schreyer: Here's a question for Guy. "Is there anything in the proposed NAFTA with respect to energy trade prospects that goes beyond the Canada-US FTA?" In other words, is there any element in the proposed NAFTA with respect to energy that is different from that which is in the FTA?

Guy Saint-Jacques: I am not able to answer that. What I can tell you though is that it would be very difficult for Canada to sign an agreement which would be less than what we got in the Free Trade Agreement, but I really don't have more information to offer. Hopefully we'll have some information soon.

Ed Schreyer: Here's a question for Gary Fuqua: 'With natural gas on the margin today, what is BPA's planning position regarding future natural gas prices?'

Gary Fuqua: Obviously, no one knows for sure what the price of natural gas will be in the future, but we have been attempting to do some forecasting and have been working with different consultants over the last few years. We are now basing our estimates on a range of forecasts, not just one: a high, a medium and a low. The advice that we get at this point, based on the discussions we've had with proponents of combustion turbines, and their willingness to fix a price for a fairly significant period of time, up to 20 years; our assessment is that there's an opportunity now. People are willing to enter into agreements which look very favourable in the price range that I described earlier.

Ed Schreyer: In addition to concentrating on conservation and efficiency (C&E), along with most Canadian utilities, who are also giving a high priority to C&E, what does Bonneville Power look to as its major source of incremental energy, if and when needed? After taking into account C&E, because C&E will only take you so far.

Gary Fuqua: At this point, we are negotiating with a group of utilities, and the negotiations include gas turbines, co-generation, geothermal, a biomass project, and a system sale from somebody who already has an existing resource. There are a variety of marginal resources at the 3 to 3.5-cents per kW·h real levelized long-term price. And I should also indicate there's a hydro resource. We just bought the output from a hydro resource from one of our customers, the Cowlitz Falls project, now under construction, again in the 3-cent per kW·h price range for a 22 megawatt energy project.

So there seemed to be a clustering of resources that are available, including gas, that are in the range of 3 to

3.5-cent per kilowatt-hour real levelized, which means first year cost of around 6 cents U.S. per kilowatt-hour.

Ed Schreyer: Thank you. Here's a question that is really addressed to all three panellists. "Do you have any comments on circumstances or situations where importing countries require satisfactory environmental performance by the exporting country?"

Guy Saint-Jacques: There is no country in the world which would tolerate another country coming to it and saying, 'Well, you are doing a lousy job with your environment and you should correct your act and we won't buy anything from you if you don't correct your act.' Especially in cases where there are thorough, complete, open processes that are taking place and processes that include all parties involved. I think it's just natural for the federal representative to get involved.

In many cases people are not aware of the reality of what's really taking place and it's a case of educating people and informing them of the very thorough processes that are in place in Canada; unfortunately, there were some cases in the past when people were not sensitized as they are now to environmental questions, and some energy projects were built without environmental assessment. But this is a thing of the past, and we will continue to oppose any attempt like that to come to Canada to criticize our performance, or to try to impose foreign environmental criteria on our energy projects.

Loren Seitz: I would like to make an observation with respect to the use of a border measure to restrict the import of a product that comes from a country that does not have in place particular environmental standards. I think the only way that would, from a trade law point of view, be acceptable is if exactly the same rules and regulations applied to all imports from all countries, and if those same rules and regulations were applied to domestic producers of that product as well.

I don't think you could identify a particular country and say, 'We will not import your products unless you accept particular environmental measures.' You would have to basically apply it to all countries and you would have to not make those restrictions any more rigorous than you would to producers of the same product in Canada.

Gary Fuqua: We, as a matter of policy look across the border with regard to environmental impacts, but we obviously don't go outside of the United States doing studies and figuring out the impacts of any power that is imported. What we've done in the past is to simply use the environmental work that had already been done, in this case in Canada, and included it with our analysis as a matter of information.

Ed Schreyer: I would offer a comment as well. Initially, my reaction was one of indignation, much the same as my fellow Canadian Mr. Saint-Jacques, but on reflection it seems to me that it depends on the depth of feeling and zeal that a person, or a group, or a nation, feel about given issues. A century ago or more, it wouldn't have been unusual for one nation to refuse trade in certain commodities if it was caught up in the question of slavery, for example. Or in the last quarter of this century, to refuse certain trade on the basis of apartheid, etc.

It is conceivable that a solicitude for concerns about environmental practices might bring nations to deal in their trade relationships with each other on the basis of such deeply held feelings and convictions. But for the moment I tend to be a little bit cynical about it and wonder out loud if sometimes this isn't done under the guise of trying to ratchet up or down the bargaining position on price. Sometimes, it's a buyers market, sometimes it's a sellers market and to introduce just all of a sudden questions like environmental background practice on the part of the exporting country, becomes an abrupt new dimension.

David Scott: Mr. Fuqua referred to 'fish-flush' exchanges in his talk and that's quite an interesting idea. I wish the program well and I hope that it does preserve the wild salmon runs. I understand that part of the fish-flush exchanges that Bonneville has in mind involve moving water from American reservoirs, which are emptying at certain times in order to allow the fish to run, moving that water figuratively speaking, to British Columbia to some of Hydro's reservoirs.

Given that the hydrologic circumstances and the fish circumstances are somewhat similar in British Columbia and the Pacific Northwest, does Bonneville take into account the possibility that you might be just exporting a damage northward to fish stocks across the border?

Gary Fuqua: I assume you are talking about resident fish in British Columbia. These exchanges of course require two parties and in discussions with British Columbia Hydro in deciding whether or not they want to do that, they take that into consideration. I would add that there is also a benefit as a result of the federal system of the United States releasing water for salmon, which eventually end up in the ocean and they are caught off Canadian shores as well. So there is a tie here back to anadromous fish which benefits Canada as well as the United States when water is released, in some cases out of Canadian reservoirs to speed the flow. So it's not just a United States issues with regard to anadromous fish and the releases of water.

Martin Hanlon: I'm Martin Hanlon of B.C. Hydro. I was just reflecting on some of the comments earlier in relation to Alcan's Nechako diversion and what were the benefits to Canada if this is an exchange of power other than getting a few getting dollars in return?

Well, my comment to them was that Canada enjoys one of the highest standards of living in the world, and we seem to forget that when we consider what benefits we as Canadians receive through trade with the United States or the EEC or the Asian world, or whoever.

Ed Schreyer: Thank you . I take it that the bottom line of your comment is that trade in energy is very much like any other commodity trade. There's an environmental dimension to it but that's a separate question.

Carolyn Linden: Could I respond to his comment? In B.C., we pay very high rates for our electricity and we sell small amounts to the States for very low rates; in my mind that's subsidizing the power that's being used in the States. I can't think of an instance where our standard of living has been improved by our sales of energy, and I'd like to hear about them if there are any.

Guy Saint-Jacques: Thirty per cent of our Canadian GNP comes from our exports. We are one of the nations in the world which depends the most on its trade and in the case of energy, if you look at the figures published by Energy, Mines, and Resources well you see that we export a huge amount of energy.

Last year we exported 13.5 billion dollars worth of energy to the States and all this money comes back to our economy. It helps Canada to maintain its social welfare system. We have one of the best medical systems in the world. I live in the States. I can tell you that, by personal experience, that you have to have your pockets full of money if you need an operation and many people envy our system. It is a choice for our societies to make, what kind of future do we want, what kind of development do we want and if the conclusion is that we should better keep our resources for ourselves, then we should assume all the consequences of such a decision.

Carolyn Linden: Could I just make one further comment? I am not sure what form of energy we were selling when we made all these billions of dollars, but I'd like to point out that the costs are also in the billions and when you subtract the so-called profits from the costs I don't think we are coming up with a plus here. The costs are not only financial costs, but the costs are environmental and we haven't even bothered to put a dollar value on those things. So to say that we are coming up with a net benefit is simply not true and I think you need to apply some simple arithmetic. But I think that as a society we are simply refusing to even think about it in those terms, and we have to start.

Comment from the Audience: Half the employment of all the people in Alberta is attributable to the petroleum industry. If you consider the service industries that service the petroleum industry. I would guess that about a quarter of that is attributable to exports to the United States, so it is a very significant broad benefit.

Looking to the Nechako people who live in the area which provides the source waters and the timbers for many of the projects in British Columbia, I would think there's a great opportunity for you, leaders such as yourself, to sit down with power companies and timber companies and mining companies and structure your arrangements with the suppliers to make sure that there is some direct benefit to your people.

Carolyn Linden: I am glad you brought up the Kemano project. It is going to cost billions of dollars, and it is going to create about 12 full-time jobs. That is a perfect example of the energy that's being produced at a incredible cost to the people who live in those areas and the jobs that have been destroyed, the forest land that's been destroyed, the soil that's been washed away, the livelihood of people who are self-sustaining who are no longer sustained at all. It's just absurd to call that a plus, because it's not a plus.

I've lived in Alberta, and I remember the oil companies tramping over the farm lands and blasting holes and building oil wells and let's not call that a plus, either. It may be a plus to some people in the petroleum industry, but I am talking about society as whole here. And as for making deals ourselves with the forest companies and the hydro companies and whoever else it was you were talking about, we'd love to but we're not given that opportunity.

Second Voice from the Audience: Ms. Linden, I don't know how many of you folks here are familiar with the study that Dr. Mark Jaccard at Simon Fraser did, where he compared the employment benefits of conservation to building the Site C dam. He found that the job creating benefits of conservation were far superior to what the construction of the dam would create. And you should also get your hands on a study that was done recently by the Union of Concerned Scientists in the U.S. where they found a climate stabilization energy strategy of reducing CO_2 by 70 per cent by the year 2030 would create a net benefit of 2.3 trillion U.S. dollars.

We need to think about the economic benefits of conservation and renewable development as well as the depletable non-renewable fossil and nuclear fuels.

Ed Schreyer: I would hope that just about everyone here would agree with your statement that conservation, efficiency, and prudent energy use practices would become universal. It certainly seems to have a good healthy start here in this province, in a number of other provinces in our country, in many parts of the United States to the south and it has been in place as a program in western Europe for quite some time now. But in addition to that, when faced with the question that if incremental capacity is needed, and if there are a number of choices or options, knowing what we know now about the various alternatives, what should be our preferred alternatives?

What should be our priorities in terms of R&D and the putting in place of this incremental capacity which hopefully will be considerably postponed because of the adoption of conservation and efficiency practices and habits.

As your moderator, I feel I should comment as well that the answer to the question, 'What is the value of energy in our society, in our country?' It is simply a case of looking to see what is our gross national production and what is the contribution from energy, by whatever measure of costs we can possibly use. There is always an argument, of course, that gross national product, GNP, GDP is not the way to measure. We should be looking at some concept such as net economic benefit or net well-being, but until we refine those indices in a way that gains a fairly wide acceptance, it's just wishful thinking.

So when looking at measures of national production of goods and services, which is what people want, goods and services, then we realize that the energy sector in Canada plays a very important role and were it not for the availability of the various modalities of energy, we would either have to buy them, import them or do without. There's no wishful thinking or thinking away of these kinds of stark choices. And one of the reasons that Canada's gross domestic product is what it is and it seems scarcely enough because we seem to be running into protracted budget-balancing problems, so what kind of circumstance would we be in if, in fact, we did not have the benefit – and I do call it an endowment or benefit – of petroleum in Alberta and in the Peace River of British Columbia and in the margins of Saskatchewan. And the teeny weeny bit in the southwest corner of Manitoba should not be forgotten.

I know that some people do, within their very being, face a kind of agony of moral judgment in terms of the advisability and the justifiability of exporting fossil fuel product at a rate which seems to put into question the matter of reserve to production ratio. If the reserve to production ratio is something like 18 or 22 years, according to figures published by the industry itself, is it prudent public policy to want to actually promote the further export of that product if we don't have the luxury of looking at 40, 50, 60, 70 years of reserve to production ratios, like Saudi Arabia, like the countries of the Middle East? If I understand correctly, in North America and in the case of North Sea Oil, Britain and Norway, reserve to production ratios on oil and gas are to be measured in terms of 20, 22, 26, 29 years.

I don't want to get into the question of the Columbia River Treaty, but in the case of the export of hydroelectric energy, I think that's about the closest thing there is to a win-win in the sense that you are not detracting from the sum total of tomorrow's generations when there is a sale or an exchange to capture the benefit of seasonal diversity. When one part of this continent has their peak demand in one season and another part has it in another season, if there is a good inter-tie or inter-connection then both obviously benefit. What could be more fundamental? It would be almost spiteful to refuse to want to take advantage of that and to create the condition in which you can take advantage of some of these possibilities.

In the final analysis all questions involving energy indirectly involve our environment, sometimes not so indirectly, and no form of energy yet thought of is totally benign in terms of environmental impact, although some are obviously more so than others. This is all part of the challenge facing us and those coming after us to find the most responsible choice, according to the criteria of each generation, the most responsible way to try and arrive at public policy with respect to energy, to meet energy needs, to meet environmental concerns, etc.

Gwen Johansson: I'm Gwen Johansson, of the Peace River Environmental Association, and I live in Hudsons Hope. I think that most of us who have looked at the figures, even the utility companies, are now convinced that conservation and efficiency not only are they real and environmentally benign, but can displace the kind of thinking that we've had for so long that has been so destructive.

I don't think that anyone in the Peace River country would accept your description of the seasonal cycle. The way in which the Williston reservoir goes up and down has nothing to do with the seasonal cycle. In fact, the government of B.C. has been quite adamant in denying any responsibility in the changes that have occurred downstream, in the Peace Athabaska delta, for example, as a consequence of the disruption that we made in the source of the headwaters in the Peace.

You can look across the country and you can see more examples of that kind of destruction; I think to suggest that hydroelectric mega-projects are a win-win situation is to grossly mislead the evidence that's now come forward, actually out of the Fresh Water Institute, where they showed that mercury bio-accumulation is a major problem. They are now doing a study looking at the creation of methane because they believe that large reservoirs may, in fact, be generating a large amount of greenhouse gasses.

I really take exception to the suggestion that we have somehow done the right thing in the past. I think we are beginning to pay for some of those problems, and you heard Doug Russell talk about the climate change. It's not business as usual, and I think that's what we are hearing at this Forum. And I am pleased to learn that there are other thinkers worrying about these problems around the world. I particularly appreciate the emphasis that Mr. Fuqua clearly brought out in his presentation about BPA's emphasis on the environment. I think we

should all be looking at environmental considerations as a major factor in trade, the same way that we should been doing in the past, not just when it suited our political will. And we should look at human rights, too.

Ed Schreyer: I certainly endorse, as I think most people would, the notion of systematic and deep searching for conservation and efficiency. In fact, that is what I think every member of the panel mentioned at least once or twice. And of course, I am one of those who agrees with Doug Russell that the concerns being voiced about the greenhouse effects. There are many of us who have been on to this for years now. This is not something entirely new at all. Take the point about hydroelectric reservoirs; because of the impounding of water that this is somehow directly attributable to or directly responsible for increases in methane and other greenhouse gasses.

I've heard that suggested before, and I would simply like to say that the Canadian tundra and even major parts of the taiga consist of water-saturated peat lands and bogs; if there is some significant amount of greenhouse gas that is emitted because of the creation of a reservoir of some square miles in size, then what is the emission from all of the hundreds of thousands of square kilometres of tundra, natural water-saturated tundra in the summer?

Someone told me just a couple of months ago that if this particular allegation is to be taken seriously then there should be a serious analysis made of the extent to which beaver dams are causing a problem because there has been a much welcomed return in large numbers of beaver to the parkland regions of the north central prairies and on the periphery. These things come to a point where we really do have to do systematic side-by-side analysis to see which of the alternatives open to us are least damaging to the environment, to atmospheric degradation, etc.

Well, there's no end to this, of course, and that's the reason why we have conferences such as this: to get together from time to time to compare notes and hear about new information that has come to light. Thank you all for your participation.

This session is now adjourned.

Luncheon Address
Energy Conservation and Public Involvement

Efficiency, Trade and the Environment

May 10 - 13, 1992
Victoria Conference Centre, Victoria, B.C.

Introduction of the Luncheon Program
by John Sheehan

Good afternoon, ladies and gentlemen. I would like to acknowledge, on your behalf, the excellent job done by our session chairmen in the conference so far, and those are, of course, John Foster, Stan Hatcher and the Right Honourable Ed Schreyer. So if you would please join with me now and recognize and thank them for their contributions to our Forum. Thank you.

Our luncheon speaker today will be introduced by Dr. Alan Pelman, who is President and CEO of Power Tech Labs Inc., which is B.C. Hydro's subsidiary that deals with our research and development activities.

Introduction of the Honourable Anne Edwards
by Dr. Alan Pelman

Today I have the privilege of introducing our luncheon speaker, the Honourable Anne Edwards. Her topic is one which I know will be of interest to everyone, 'Energy Conservation and Public Involvement.'

The Honourable Anne Edwards is the B.C. Minister of Energy, Mines and Petroleum Resources. Prior to the 1991 election, she was the Opposition spokesperson for that Portfolio, and was a member of the legislature's Select Standing Committee on Energy, Mines and Petroleum Resources. Ms. Edwards received both her Bachelor of Arts degree and her Master's of English from the University of Saskatchewan. Before entering politics, she worked as a journalist and a college instructor. She has been the MLA for the Kootenay riding since 1966.

Please welcome the Honourable Anne Edwards.

Luncheon Address

Energy Conservation and Public Involvement

The Honourable Anne Edwards

Minister of Energy, Mines and Petroleum Resources

Energy Conservation and Public Involvement

It is certainly a privilege to be here for such a well-attended conference. It's probably a consequence of the fact that the Energy Council of Canada has joined in with B.C. Hydro for its annual conference and also we have an international component this year which is, as I hear from those of you who have been attending these sessions, a very exciting addition.

I would like to commend the organizers of the conference, B.C. Hydro. I think that they've done an excellent job, and I would also like to offer thank-you's to all the people who have done specific jobs and also the thank-you's to those of you who have helped them do so. I am sure that the next Energy Forum, in 1993, will be equally good.

I am going to discuss the two topics that Alan talked about, but I am going to begin by defining where energy fits in British Columbia. And I wanted to talk about that a bit, and get some ideas going, because I know you will talk to me later about this, about where Energy fits into the economy, where it fits into the environment.

Energy in British Columbia is key to our well-being. It's critical to our industries, which are globally competitive, partly because of our energy. The relatively low-cost abundant energy of this province is, of course, vital to our standard of living. Energy is related to the environment in the sense that it has impacts. It doesn't matter whether it's a small or a large project, every energy project has an impact on our air, our water, our land, our climate, our fauna, whatever. That is an important issue and it's becoming more important.

It may have impacts from region to region that are different, but it certainly has impacts regionally as well as globally and of course, we like to think of energy from a global perspective, let's put it that way, in the same way that we look at our global economy.

Here in British Columbia, we're a bit different from some other provinces in that we have very abundant resources. We have undeveloped hydro resources sufficient to actually double our current production levels within the province. We have natural gas production which is almost double what our province needs. Now, we do import petroleum. We only have about 20 per cent of our needs in oil here in B.C. As well, we have vast quantities of coal; most of which is exported to Pacific Rim countries but some of it is exported around the world. And it might be well to note that our forest industry supplies two-thirds of its energy needs through wood residues.

What this says, of course, is that this endowment makes the issue of conservation one that's a little different here when compared with other people who don't enjoy these kind of abundant resources. So when we look at conservation, we must keep in mind that what we are doing is looking at it against a background of very abundant energy resources. What this abundance has also done is led the province to be one of the most energy-intensive economies in the world. Critics sometimes look at that and suggest that we are energy hogs and, in some respects, they may be right.

But basically, there is the other part of that dimension, which is that we are able to put into our economy those kinds of industries which do use a lot of energy. This, of course, gives us a competitive edge in the global economy and it also gives us more local options.

This basically says to us in British Columbia that the challenge for the next decade is to guide our policy development. We have to put some guidance on it because if we leave it to go the way it has been going, it will probably not do what we want it to do. In other words, if we simply look at the bottom line and don't consider the externalities, if we let it go on as before, we are unlikely to get out of our energy sector and our energy planning what we want.

We, as a government, intend to face this challenge within the context of our firm belief that we must have sustainable development in this province, and I think it's fair to say that we agree with the definition of sustainable development as stated in the Bruntland report, 'Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.'

What we need then, if we accept the challenge, if we have defined the context, is to establish a strategy. What we hope to do is establish a strategy for energy production and for energy use. In the broadest terms, that means that we want to maximize our benefits, minimize our negative impacts and involve the public.

How do we achieve this? I think that's something you've been dealing with at some of the Forum's workshops.

I am going to offer you some ideas. I am sure that I'll get lots of advice back from you in return. First of all, what we want to do is more comprehensive planning. We are committed to building a consensus on a sustainable energy future. It's basically what you might call comprehensive planning. We want to look at the 'whys.' We want to know why we are doing it. We want to plan for it, why we are doing things so that we can then go where we want to go and know why we want to get there.

Right now the menu of energy choices is based on resource options that utilities have selected and the public has been relatively uninformed. Historically, it's been the way things were done but we believe that we need a change. We want to look at the 'what', too. It's what do we want, what have we got? For a sustainable future, we must consider all our resources and all our methods. We are going to look at all resources: coal, gas, oil, hydroelectric, wood waste, wind, sun, tides and geothermal. We must look at all the sources of energy. We've got to look at demand-side management and conservation. We want to look at new supplies. Where we are going to get new supplies, new generating capacity? And certainly in British Columbia, we have to put into our planning basket the return of the Columbia River Treaty downstream benefits.

Those decisions are going to be crucial to our future, both our near future and our more distant future, but they are only part of what we are going to do with our planning. We are going to have to look at efficiencies in our transmission and our distribution systems. Fuel-switching is another aspect that we are going to have to look at and of course, develop new technologies. We are also going to have to evaluate different factors in the energy equation, externalities that I mentioned before, the kinds of things that have not previously been included in how we decide what sources we are going to use for our electrical power and how we do all our energy planning, where we get it.

We need to look at global warming, too. That is not currently something that is being considered as part of the total cost of our energy. We are going to have to look at the objectives from region to region, we are going to have to make some trade-offs. There may be jobs coming out of some projects, but we may also want parks in some areas, and therefore we've got to make some of the choices and some of the decisions that may not be easy but that are the only way that we are going to move ahead. We are going to have ensure that the desires of all of the people are considered, and that means that we must consult a very broad cross-section of the public for input into our decisions.

We want to make sure that we don't just hear from the special-interest groups, not that they aren't important and necessary. Everybody who has a special interest has probably more inside knowledge and more commitment to begin with, but we want also to spread that out to go beyond that to include the general public and to make sure that they can be involved.

Now, to achieve this strategy, we are putting in place a brand new **British Columbia Energy Council**. The Council's task will be to consider the province's energy future as a whole; to look ahead, to look broadly and to involve the public in the process. The first thing is to look at the province's energy future as a whole. Instead of looking from one particular commodity, one particular form of energy, the council will be looking at all forms of energy and decide what should happen within the province. The Council will have as one of its main tasks to inform and to evaluate options for society in general. As I said, we want the Council to reach out to all people within the province. One of its responsibilities will be not only to go out and listen to the broad general public, but also to put out information; information that is balanced, to give the public the opportunity to participate intelligently in the discussions that are going on.

I don't want to go any further without people knowing that a part of the task of the Council is to put out good information and broad information and balanced information. Another part of what we expect the council to do is to see the environment as part of a larger ecosystem so that the whole issue of energy in the province is considered in the broadest terms. The Council, we believe, will develop a collective vision for British Columbia, so that we will have a provincial consensus on what directions we want to go. We want agreement on ways and means to reach a sustainable future in energy for us in B.C.

The B.C. Energy Council will be an independent body. It will conduct comprehensive long-term planning, as I said. But it will not be involved in the review of specific projects. That is the task and has been the task of the Utilities Commission. It will not be the task of the Council, because it will operate at a policy level. It will not be responsible for utility regulation. There is no overlap there.

As many of you know, the Chairman Designate of the B.C. Energy Council is Dick Gathercole. He will be the Chief Executive Officer of the Council, and I believe he is eminently suited to that position. Now, Dick has been in British Columbia for a long time, in the land of zany politics as some people have said, and, believe me, our politics slop over into the energy field. He knows how energy works in British Columbia. He has been working with the public advocacy centre for the past eleven years. He has been at Utilities Commission hearings and working with energy issues for all forms of energy. He also has the training as a lawyer to take issues and deal with them in a balanced way, an objective way. So I am very pleased that he has agreed to do this job and

to lead this B.C. Energy Council when it is beginning in its formative time and when we get it moving off the ground and on the run.

There will be six other energy councillors named. They will be part-time councillors, members of the Council and I have canvassed as many groups as I can think of within the province to give me nominations for these six positions. Now, there will only be six positions, but we are hoping to somehow balance the interests of energy consumers, of the energy industry, of environmental groups, of communities, of aboriginal people, of academics. We want gender balance and we want regional interest. As you can see if we get to that we have a great hope of further success. We'll try to put all those things into six people. If we can, we will. We sincerely hope that we can make a good stab at representing all those interests in the six people that we put on the B.C. Council with Dick Gathercole.

The B.C. Energy Council will have its headquarters in Vancouver. It will have a small secretariat and its expenditures will be recovered from the provincially regulated utilities. For the first year its budget is expected to be about 2 million dollars.

We are also looking forward to the development and use of different methods of talking with and working with the public, in getting views together on British Columbia's energy needs. We hope that there will be a number of experiments in how we do this.

Public opinion in British Columbia is currently extremely diverse and, in many ways, extremely compartmentalized. People have ideas about one aspect of energy and about another aspect of energy and they don't necessarily put them together. Often, concerns about environmental and land-use impacts don't fit together with the production and consumption ends. Sometimes there are people in the same community or sometimes even in closer proximity, in the same household, who are more concerned about the impacts on the environment than others who are primarily concerned with exploiting resources to create jobs. Both of these are significant and legitimate concerns.

There is often a minimal connection in people's minds between their own lifestyle and their need for resources, and what they want done with our energy future. There are regional differences on economic and environmental and social trade-offs and there is certainly a desire for involvement which sometimes is not as consistent with the other parts of what goes on in life as one might hope.

Certainly there is a great desire to talk about energy in this province, as far as long-term energy exports are concerned; this is an issue that most of you know about, about the obligation to serve new customers, and about resource options. When we look to our future, what are the resource options and which are we going to choose? Global climate change is an issue, as is regional air pollution. This process with the B.C. Energy Council will go further than earlier processes which were also somewhat compartmentalized and the processes that will be used will feature, for example, simultaneous public reporting of the findings, simultaneously to the public and to the government.

We hope that the Council will provide a continuing two-way flow of information between the government and the public on energy issues. There will be public input into decisions and, as I said before, we are hoping for very flexible techniques for achieving that public input. And we are hoping that the input will go broadly beyond, perhaps, some of the people that currently have been very active and very interested in participating in decision-making but it may be a broader group.

In light of this conference's specific themes, I think the second part of the terms of reference of the B.C. Energy Council is relevant, and that is that the Council will, in addition to comprehensive broad long-term planning, also deal with specific issues that are referred by the Minister. For example, the Minister is going to refer the issue of long-term firm electrical exports from British Columbia to the Chair of the Council immediately. I believe that the issue of long-term firm power exports is a good example of why we need the Council.

The former Minister of Energy, the Honourable Jack Davis, made an announcement several years ago, that we were going to have the export of electricity, we were going to export electricity on a long-term firm basis from British Columbia. When he was questioned, frequently by me and by others, as to what was the public basis for this decision, "When was the public going to have it's say about whether or not they thought it was a good idea to do that?" The Minister frequently said, and as far as I know he was quite consistent about this, "When we have a project, it will be reviewed by the Utilities Commission." Well, that means that we would be reviewing a single project and what would come down on that poor proponent's head but every view on electricity export that anybody ever had, and I wouldn't blame anybody for trying to intervene. It's the first opportunity they would have had to have a say in whether or not we should export electricity.

So basically, we feel there has been no formal public consultation on this issue to date. There certainly does not appear to be any consensus on it, and that's been confirmed by the kind of polling that we've had. There are views, very strongly held views at almost every point on the spectrum about it, but there is probably no consensus.

The public concern remains on the effects of exports on our long-term electricity supply and certainly upon our environment. We need a serious and a bal-

anced public review to protect the public interest on this issue. The Council will be able to identify the conflicting trade-offs, will be able to rank the priorities and will be able to suggest a resolution for the issue. The process will lead, we trust, to a more settled policy climate within British Columbia and commitment from the people who participated in the process. As for the time frame, and we've been asked to hurry on this, and we know it's an issue of great concern to a number of IPPs. So Mr. Gathercole will be consulting with the stakeholders on an early time frame to make his report on this issue.

So to look to what our vision is in British Columbia, I think we first need to put the idea forward that British Columbia needs public involvement in energy planning. The government wants two-way communication with the public and is going to put the machinery in place so that we can have that communication. We are convinced that we need to coordinate all the energy sources and that includes the traditional supply, the demand-side management work, new technologies, alternative energy sources and of course, the return of the Columbia River Treaty downstream benefits.

We are committed to accounting for environmental externalities. We want the way we cost energy, the way we put a price on it, to include the extraordinary elements that we have not previously included in the mix. We believe that we need a mix of private and public enterprise to make the province work well and certainly to make the energy aspect of the province work. The private sector will assist us in innovation. It will assist us in cost minimization. The public, and the government itself, has to see that the public is involved and that we are going in the direction that is for the public good. The government also is committed to show leadership in all areas of public interest.

We will ensure that we work together with the public and although I am sure we will continue to have disagreements, because there will be difficult choices, we will have put the issues out as well as we can, we will be listening and that we will be responding to what the public wants.

Well, most of you people here in this audience are leaders in the energy field in British Columbia and around the rest of the country and beyond. There are people here from other countries. Certainly to the people in British Columbia, I can state that we know that we have to work together to balance our objectives. We have objectives, as I said, which range from the environmental and the economic to the social and the regional. We are interested in conservation and efficiency.

It sounds as though it's going to be a difficult job to balance them all and to reach some conclusions, some decisions, but I think that the kind of conference that you're having here today indicates that it is possible. It indicates that there are a number of people that want to work this way and a number of people who, I hope, share my optimism that if we go forward and if we continue to work together, that we will be able solve most of these problems and to continue to make energy a significant part of our economy, a significant helper to our environment as much possible.

What I am trying to say is that I am confident that we will do better in the future even than we do now.

Thank you very much.

John Sheehan: To thank our speaker, I will call on Phil Larstone of the B.C. Environmental Network Energy Caucus.

Phil Larstone: I would like to extend a very warm thank you to the Honourable Anne Edwards for blessing us with her presence here today and her encouraging and inspiring words about her plans for our energy future. I would also like to thank the Minister for quickly moving towards meaningful public involvement with the establishment of the B.C. Energy Council Act and for her appointment of Dick Gathercole to the Chair of the new Council.

As a way of showing our support for that, those decisions and Mr. Gathercole's appointment and for the very forward thinking public involvement that will likely follow, I would like everybody who is support of this to join with me in a round of applause.

That was meant to congratulate Mr. Gathercole as well. In closing, I would just like to say that on behalf of my organization, the Environmental Network, it is our sincere hope that this will be the government, under the Ministry's leadership, that will set a new direction for B.C.'s energy path towards displacement of unsustainable energy practices with sustainable energy sources and conservation and benign technology so that the children of B.C. can look forward to a future of health and prosperity and abundance in the natural world.

Thank you.

John Sheehan: That completes our luncheon program. Thank you.

Wrap Up

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

John Allan has worked on natural resources issues since 1974. He holds a Bachelor of Arts(Hons.) from the University of Winnipeg and a Master of Arts in economics from Queen's University in Kingston. He joined the Ministry of Energy, Mines and Petroleum Resources in 1980. He has held several senior positions in the Ministry, including that of Assistant Deputy Minister for the Energy Resources Division from 1988 to 1990, when he was appointed Deputy Minister of Energy, Mines and Petroleum Resources. Mr. Allan is a Director of the British Columbia Petroleum Corporation and is the provincial representative on the Columbia River Treaty Permanent Engineering Board.

Wrap Up

Discussion Group Reportage

Introduction of Jim Savage by John Allan

Good afternoon, everybody. My name is John Allan, I am the Deputy Minister of Energy, Mines, and Petroleum Resources here in the Province of British Columbia, and it's my pleasure to welcome you to this session. The first session this afternoon will be run by Mr. Jim Savage.

Jim is a Principal in Savage and Associates and in that position he is a researcher, writer and event organizer. Jim's firm has conducted research on the implications of technological change for forest industry employment, has coordinated small business training programs and has planned provincial conferences on citizen participation and sustainable development for resource based communities. Mr. Savage has worked at a community economic development planner, environmental advocate and energy management columnist for *The Globe and Mail*.

Good afternoon, everybody. Welcome to this session, in which we are going to tell the members of the Energy Council of Canada who were unable to attend the Forum discussion groups over the past two days a little bit of what went on. And for those of you who did attend the workshops, we'll try to summarize for you what went on in the other discussion groups you couldn't attend.

This is the fourth time that discussion groups have been held at an Electric Energy Forum. The format has changed somewhat each year, as the planners have adopted new approaches, and this year is no exception.

1. Format of the Discussion Groups

B.C Hydro convenes discussion groups at it's annual Forum to help the participants, including Hydro staff, to learn about and discuss topical energy issues. These groups also allow Forum participants to exchange ideas with each other and with Hydro personnel; the sessions are one of the ways that B.C. Hydro learns about theconcerns of ratepayers, environmental organizations, industrial energy users and others.

This year's discussion group sessions focused on the following issues:

The Columbia River Basin: A Step Towards Integrated Resource Use. This group examined the status of the Columbia River Basin Operating Program, and the ways that B.C. Hydro can develop an interactive, cooperative approach to integrated resource use.

Electricity Trade. This group investigated some of the histories and complexities of electricity export/trade, and the benefits and costs associated with electricity trade.

Planning and Choices: The Future of Electricity Planning. This group explored how more effective integrated planning can be achieved in B.C., e.g., how to link planning processes between communities, governments, business and industry.

Alternative Energy. This group looked at what could be included in a new B.C. Hydro alternative energy strategy, and the implications of wider implementation of alternative energy strategies in B.C.

Public Involvement. This group was held in the spirit of exploration, to examine some of the basic questions that must be collectively addressed to allow society to undertake successful public involvement processes.

A Sustainable Strategy for Energy. The B.C. Round Table on the Environment and the Economy hosted this discussion group to receive feedback on its new study on energy use and planning in B.C.

Approximately 200 people participated in the discussion groups over two days. During the final Plenary Session of the Forum, a panel presentation reported on the highlights of each session. The transcript of each of these presentations appears below, including discussion from the floor. In addition to the panel transcript, a written report was prepared by the organizing team of each group. These reports have also been included in these Proceedings, following the Workshop discussions.

The purpose of the discussion groups is to stimulate interaction between you, the attendees, the sponsors and amongst each other. The discussions let B.C. Hydro learn from you about where you stand on different issues. The B.C. Round Table session was the first time that Hydro has invited another group to hold a discussion at the Forum, so it will be interesting to hear the report on that discussion.

2. Workshop Facilitators' Reports

The time is too short to do detailed summaries of what happened in each workshop during hours and hours of discussions. What my friends beside me on the stage are going to do is to make a few key points about the sessions that they attended and, in the interests of time, they'll even be introducing themselves. They will make very brief statements about their discussion groups to try and stimulate some thoughts and questions, and then we'll move to an open discussion.

I hope in the open discussion that people will be able to keep their questions and remarks short and to the point, because we are open to statements as well. Please keep them very brief so that we can get lots of 'to and fro'. I've asked the panellists to keep their responses to your remarks brief so we can cover as much ground as possible.

So without further ado, I'd like to call on Moira O'Neill, who'll introduce herself quickly.

Moira O'Neill: Electricity Trade

As Jim said, I'm Moira O'Neill and I'm the President of O'Neill and Company, a management consulting firm based in Seattle. I was privileged to be asked to facilitate a lively discussion group on the subject of Electricity Trade.

It's estimated that before the end of the decade, about 20 billion dollars will be spent on new generation and conservation programs in western Canada and in the states of Washington, Oregon and California. So, understandably, there's a big debate emerging on how much, and what type, and how, and at what price you might want to participate in this energy export market over the next decade.

In our group, we quickly decided that short-term electricity exchanges and exports of one to four years were probably not particularly controversial and really made a whole lot of sense for both B.C. Hydro and the States. But we then moved on to what is probably the thorniest issue that has emerged throughout this conference: the tough issue of new long-term projects built for the long-term firm export market. We had some people who felt that there ought to be a free competitive market that would, in fact, create lots of jobs and revenue for the province, and that existing regulations were sufficient. On the other hand, there were others, not surprisingly, who really could see almost no circumstances in which they would actually agree to or support long-term firm exports. No consensus here.

In summary, I think that the debate will continue and this was an interesting opportunity to discuss this issue outside of export hearings and formal council meetings; this was really an opportunity for about 70 people to share their various perspectives in a very informal setting and I hope move the dialogue one step further for the province to be able to make a policy decision around electricity exports. Thank you.

Mike Talbot: Public Involvement

Thank you. My name is Mike Talbot, I am the principal of Michael A. Talbot and Associates, Organizational Development Consultants. Our firm specializes in employee involvement on one hand and, on the other hand, with public involvement.

I was part of the discussion session on Creating Public Involvement, which looked at the issues involved in creating successfully getting the public involved in planning issues. The themes that emerged from the discussion were that the people who are most affected by decisions related to energy projects and other major changes around energy are those people who should be very involved with the decision-making right the way through, perhaps using the kind of collaborative model that was described this morning.

There was a general recognition that public involvement processes are expensive, both in terms of time and money, and that characteristics such as trust, openness and clarity of expectations are very important for their success. It was recognized that the public itself should be broadly involved, but there was always a difficulty in figuring out who should represent the public in a public involvement setting.

From the point of view of one who was involved in the design of a discussion group, as I was with Nancy Cooley, it was fascinating because we offered a fairly structured approach to examining these kinds of questions but also provided an open discussion area for people who wished to just address any topic under the general heading of public involvement. About half the group chose to do that. That was interesting because it was not what we had expected. We thought most people would want to go for a more structured approach and with the materials provided.

When we looked closely at the feedback sheets turned in by the participants, we found lots of interesting points. None of these were really new, in the sense that all those points were things that we had thought about when we put the session together.

Finally, we have this dilemma of who creates these sessions and how can you have involvement in creating a session on public involvement?

Ezra Auerbach: Electricity Planning and Public Involvement

My name is Ezra Auerbach and I'm here as a Director of the Solar Energy Society of Canada.

I am reporting on the 'Electricity Planning and Public Involvement' discussion group. The general purpose of this discussion group was to examine the ways

in which public involvement could, or possibly even should, take a role in utility planning. It was generally agreed by all in the group, including utility representative, that greater public involvement should take place. There was less certainty as to how.

It was agreed that in order for meaningful public involvement taking place there had to be education. It was really interesting to note that education was supposed to go both ways. People generally felt that just educating the public was only half the battle. The public needs to educate the utility people that the processes of input needed to be flexible and to be adaptable to the communities' needs. If the utility didn't get back to the communities after hearing from them and indicate that not only had they listened but they had learned, then the process would fail.

Interestingly, the area of most difficulty was in deciding when input has to stop and decisions have to be made. That's when the room came to a resounding silence. Thank you.

Lee Doney: B.C. Round Table on Sustainable Strategy for Energy

My name is Lee Doney and I am the Executive Director of the Round Table on the Environment and the Economy.

Our discussion workshop dealt with the Round Table report that has just been released, entitled *Strategy for Sustainability*. We tried to structure our session into four working groups to look at the issues of what is energy sustainability, what are the principles around which that should be developed; issues of global warming and recommendations on global warming; issues of energy efficiency; and, finally, conservation and recommendations that we've made around these in energy pricing.

We left the alternative energy technologies and energy export sections of our report out as they were being dealt with by other discussion groups.

As you can appreciate, we had very broad areas to cover, and I couldn't do justice to the kind of discussion that occurred in each of the four working groups in our workshop. I won't even try, because a 30-second signal is lit up in front of me, and I haven't even had a chance to start talking about these issues.

But let me just say from the perspective of the Round Table that to have an opportunity to come to a Forum like this, and to debate our report that is now in the public's eye, is an exceptional opportunity and one that the Round Table and I certainly support. I'd like to see it happen more in the future, not just with Round Table documents but other public domain documents. I think it proves that we need to broaden these discussions. These kinds of Forums are a very cost-effective way to do that, by B.C. Hydro simply inviting and helping to fund some of the environmentalist to participate. I think we got a 'rounder' discussion going and it certainly was nice to see a lot of the people that had already participated through our processes, stakeholder processes and public forums, here again but also to see a lot of new faces and hear new perspectives.

From our perspective, it was a very worthwhile initiative. Thank you.

Bob Evans: Alternative Energy

I'm Bob Evans and I'm with the Department of Mechanical Engineering at UBC. I was the group facilitator for the Alternative Energy discussion this morning.

Altogether, we had a two-hour time frame for our discussion. We didn't spend too much time talking about the process of public participation, we kind of got on with the job and asked the 60 or so people in the room to rank nine different alternative energy technologies in order of importance as they saw it from their point of view.

We divided the group up into six tables and found six very hard-working table facilitators. We asked people to stop after one hour and have their table facilitator report on their initial preference rankings of the technologies. At that point, we provided some additional cost information to each table and asked them to go back and re-rank the technologies if they so wished, and to also provide a list of initiatives that they felt B.C. Hydro should be looking at to implement an alternative energy strategy. The process worked remarkably well. We ended up with, I think, an amazing consensus, pretty well at the end of the two-hour session.

In terms of ranking, we divided the technologies up into short-term, medium-term and longer-term technologies. In the short-term or immediate technologies that people felt we could get on with right now, were included wood waste utilization, wood waste co-generation, that sort of thing, and small hydro, small-scale hydro, wind energy and municipal solid waste, pretty much in that order. In the medium-term technologies, there were fuel cells, geothermal generation and solar photovoltaic generation.

Over the long term, I think we pretty well agreed there would be tidal power and wave energy.

As far as the initiatives for implementation is concerned, we came up with four:

(1) Hydro should be doing more in terms of resource assessment, particularly in the wind energy area where there is really very little knowledge of the wind resource out there.
(2) Hydro should be utilizing full-cost accounting in evaluating each of these technologies.
(3) Hydro should be looking at financing small

individual generators who utilize alternative energies.

(4) Hydro should fund and coordinate some R&D in all of the areas.

Glen Sinclair: Columbia River Basin Integrated Resource Use

My name is Glen Sinclair. I am with Beatty, Dunwoody, Ward and Mallette, a firm of Management Consultants and Chartered Accountants in Vancouver. Our workshop was asked to bring the people on the Columbia River Basin Operating Program some additional public input into their ongoing discussion process. Now, there is a public involvement program already underway through several means, but we wanted to get some new ideas from the wide diversity of people in our discussion group.

And that certainly happened. There were a lot of useful ideas and some valuable cautions that were voiced. They will be noted in our report for the Forum Proceedings.

But I thought there were four things that came out of the process that were worthy of note.

First, perhaps one of the main benefits of the discussion sessions was that people could see B.C. Hydro officials actually leading serious input sessions themselves, listening, trying to understand and to gain a better understanding of local views.

Second, because we had some people here from the Kootenays , it also reinforced the credibility and the viability of the recommendations they themselves have put forward earlier. Because a lot of the things that came up were in fact, reflective of what we had earlier talked about in the Basin, so it provided reinforcement that public involvement does, in fact, work.

Third, I think the results provide reinforcement to B.C. Hydro that it is worth while to intensify and to expand their sponsorship of public involvement because, in fact, it will lead to better decisions.

Fourth, I'm wondering if it may not also have helped set the stage for a new expanded integrated resource management program in the Columbia basin on a multi-partner basis. I would just like to suggest to any of you who have the ear of the Minister, that maybe it's time that we start looking at river basins such as they are now, thinking through the 'Green Plan' for the Fraser Basin, and so that people from Hydro do not have take the unenviable role of trying to chair and participate at the same time. I think they should be allowed to participate and let other organizations actually do the chairing.

Anyway, it was a very interesting procedure, and I would just like to thank the public who attended, as well as the technical experts that participated.

Jim Savage: I would like to thank eight or nine people who volunteered to help facilitate some of the discussions in the alternative energy group and in the public involvement group. We found those volunteers by including a request in the package we mailed out before the Forum. I think most of you will remember that letter appealing for volunteers, and it worked. We ended up with a good mix of talented people, and I would ask you to give those people a hand for helping out.

The Proceedings that you will receive automatically as delegates will include fuller reports on the sessions than those that were presented here.

Cecil Kelly: One of the things that I think is very important is that we came all this distance to participate in this Forum, with all the paper that was sent to us before we got here, we should have had some direction on how the facilitating was going to take place and the rules, so we would not have spent so much of the time prior to the actual discussions deciding how our workshop was to be conducted.

But I'd like to say that I really appreciated the opportunity to come down here and exchange views with the Forum delegates.

Jim Savage: We did mail out instructional kits to early registrants for the discussion groups. I'm sorry you were missed.

Lenore Herb: I'm Lenore Herb, President of SPEC. The amount of material and the very good discussion that went on in the panels today and yesterday afternoon was a great contrast to the panel that we heard yesterday morning on Energy Trade, which all seemed to be about 'Business as Usual.' And there just seems to be such a positive change today, in terms of very constructive issues regarding public involvement, public process, conservation potential, alternative energy, contrasted with that panel yesterday morning.

I felt very discouraged after yesterday morning's panel, whereas today I feel quite different, in terms of knowing that there are a lot of people out there who are working in a very futuristic sense, whereas it's clear there's a lot of power and money tied up in maintaining the status quo.

And I'm just wondering, when are we going to start being able to apply some of the work that we are doing here in terms of alternatives and conservation, when is that going to start entering into energy planning? How are we going to put these two together?

Voice from the Audience: Perhaps that might be an assignment for the new B.C. Energy Council to see if they can bring some of that together; it would give them something to do in the first few months.

Second Voice from the Audience: One of the suggestions of today's working group on renewable energy choices was, and I think this was common to all the working groups, was that at the next Energy Forum we should get a report from the senior management of B.C. Hydro, telling us exactly how they implemented the information that came out of our working groups, how it was used, how it affected budgets, what money was spent on it, what work was done on it, as a way of knowing that, in fact, we are not just talking into the wind here. I thought that was a reasonably good suggestion made at one working group I attended.

Paul Hambruch: I'm Paul Hambruch. I come from the Columbia River Basin, where we were obviously affected by the dams that were built there. I was impressed with the way a lot of people grappled with the need to conserve energy and if I take home one thing that really hit home with me, it is that energy conservation starts right here with me. If we all can take that home and put that out to everybody in the province that "Unless I personally do something, nothing is going to happen," then we've achieved something.

Doug Gook: My comments are in regards to the breakfast session early this morning that presented the B.C. Environmental Networks Energy Caucus Policy Paper. **No bias because of my involvement with the B.C. Environmental Network, and I did manage to attend a couple of their energy caucus meetings.** I hope you all appreciate the level of volunteer commitment and work that many of those caucus members put in during the development of that policy.

Unfortunately, I felt that this report could been given a higher profile, and I would suggest that the detailed work on their very refined suggestions should be dealt with in a larger format. It might not compare to the paid preparations of some of those panel presentations or even some of those workshop discussion papers. But, considering the amount of volunteer effort and energy and expertise that went into that document, I think it needs to get a much more detailed look by a larger gathering, like this.

Phil Larstone: I'm Phil Larstone of the B.C. Energy Coalition. My comment relates to the timing of this Forum. I would like future Forums not to be scheduled during the planting season for all of us people who have decided to take responsibility for at least some of their food requirements and feel the need to work with their hands in the soil at this time of year. I think there's more appropriate times of the year for this kind of thing so that we can respect the seasonal cycles and not have to make that sacrifice in order to participate.

Tim Bradshaw: I'm Tim Bradshaw and I'm a high school teacher here in Victoria. One of the big concerns that a lot of my students have, who are environmental club members, is where is the future for them?

Now we've got an expert here on solar energy here. A lot of the kids talk regularly about why don't we just set up solar panels out in the clear-cut logged areas of our forests to provide electric energy while the trees regenerate, etc. I am wondering if you can give us any feedback, any input so that I can take some optimism back to the kids, who are discouraged about how the world is going.

Ezra Auerbach: I am afraid you are probably not going to get much satisfaction from what I have to say. Solar electric modules are fine, very compact generators of electricity. They are made in factories. They are not made by cheerful happy workers; I have never seen them singing on assembly lines. Importing technology to put into our clear-cut areas to generate electricity won't make the dent into our children's lives that conservation can.

What you want to tell the kids in your class is to think about conservation when they are about to put one more thing into the dryer in the morning so that they can wear it to school. That's going to have a far greater impact than solar panels in the woods.

Glen Sinclair: I would like note that I was really happy to see students attending the discussion groups this morning. I think that they added some, not so much a sense of naivete, but rather they brought a real sense of serious concern about our environment and society.

I'd like to put it out to the private sector, not just to B.C. Hydro, that maybe it would be a good idea if each private-sector attendees that comes here sponsor one student to come with you next time. Maybe we get the football team and the basketball team members. I mean, I am all in favour of the people that are very keen on the environment being here, but I think there's a whole lot of people we are still missing and those are the people who are going to be running small businesses, who are going to become the future lawyers that Bill Wilson may not like, but he happens also to have gone to the same Law school as all of them, so he's one of them, and the future doctors, and so on.

But what I am getting at is that professional people like the accountants, who have to figure out how to do environmental audits aren't here. No doctors or nurses. A lot of professions aren't represented here.

That's why I was really encouraged to see those students and I would just suggest if you want to do one thing next year to really kick this thing up a notch, you fill this place half full with students. Students who are serious, but don't necessarily know why they are here, because that then you'll get the dialogue going with some of you who are beginning to wonder whether there's only two visions, the greed that Bill Wilson talks about, which maybe we need, and on the other hand, the need for a longer perspective. Where's the middle ground?

So maybe if we got more of these middle-of-the-road students here they'd help us show that both sides have got some very important things to say. You know, I felt that in our group that happened today. And I don't know whether they were your students but one of them even had a teacher that they dragged along and I was really pleased about that.

Voice from the Audience: We are all students.

Lenore Herb: I just have one more comment. Although I was quite glad there weren't any women on yesterday's 'business as usual' panel in the morning, I would really like to see a better a gender balance at next year's Forum, where women are actually encouraged to attend. Today's audience is mostly men but I suppose that can't be helped. But women could be better represented as members of the panels. Thank you.

Jim Savage: That's all the time that we have, ladies and gentlemen. I would like to thank everyone involved in the discussion groups. Nearly200 people attended and it was quite a lot of fun, I think, for most people. And I'd especially like to thank the volunteers on the stage with me for taking their time over lunch to prepare their comments and for being so concise. Thank you again.

Post-Forum Discussion Group Summaries

Columbia River Basin Discussion Session

Purpose: To gain useful ideas for the Columbia River Treaty Operating Program (CRBOP) team regarding taking constructive steps towards the establishment of **integrated resource management** within the Basin and within B.C. Hydro's way of operating. The detailed agenda is contained in Appendix One.

Results: The Columbia River Basin Operating Plan workshop was well attended, generated considerable input and feedback and gave both BC Hydro and the local community considerable reinforcement in their efforts and procedures to date. The cross-section of people was extensive and very helpful.

There are a wide variety of useful **visions**, which contain some valuable cautions (**roadblocks and detours**) as well as some **opportunities** as to how CRBOP should proceed. A complete summary of all the input and feedback is included in Appendix One. It should be circulated to the appropriate BC Hydro staff as well as those participants who requested it (names and addresses are provided).

In addition to those visions and constraints that were most supported, there are several significant impacts that emerge from the proceedings:

- The main benefit may have been people seeing B.C. Hydro officials lead serious **input** sessions and listen/understand/respond to suggestions and feedback.
- It reinforced the credibility and viability of local input received to date through the **public involvement and consultation processes** conducted in the Columbia Basin, i.e., the Public Involvement Program (PIP) has been working and the input has been valuable.
- The results provide reinforcement to BC Hydro to intensify and expand their sponsorship of PIP and Integrated Resource Management (IRM) education in their work(s).
- It may also have helped set the stage for a new, expanded IRM program in the Columbia Basin on a multi-partner basis (like Okanagan Basin Water Study, Fraser Basin Management Program, etc.).

Visions Offered by Participants

A1 Formal, binding plan developed by and agreed to by all parties
B1 Basin-wide integrated resource management planning process
C1 Total integrated resource management
D1 Stakeholder's **Round Table** to direct Columbia Basin management
A2 Prepare integrated resource use plan
B2 Residents point-of-view
C2 Establish a cooperative process to manage interdependency of resource and community interests
D2 Independent, province-wide, comprehensive study of **all** options available for needed generation (give *real* examples of alternatives and their impacts)
A3 Decision-making responsibility for watershed stewardship by a balanced local council (responsibility for all resources)
B3 Better coordination between stakeholders
C3 Joint debris management with other stakeholders
D3 **Full** cost-accounting of US benefits that don't offer a return on investment to Canadians.
A4 Fish and Wildlife programs developed through a public process
B4 More information on expected operating ranges
C4 Do not build the Murphy & Border projects
D4 Strike balance between local property rights and export markets
A5 Manage for biodiversity of all species simultaneously
B5 Better funding arrangements for operation and maintenance
C5 Seek effective public involvement program
D5 Explain what BC Hydro actually has responsibility for
A6 Power benefits ($) pay for enhancement and remediation
C6 Improve recreation facilities

Roadblocks, Detours & Opportunities

A1 Research into biological systems paid for by power benefits
B1 Confusion of roles & responsibilities

C1 How do you place a value on environmental resources
D1 Columbia River Treaty and non-treaty storage Agreements
A2 Lack of thorough understanding of biological systems
B2 Decision processes to integrate multiple vaues
C2 Who makes the decision?
D2 NIMBY attitude - "not in my back yard"
A3 Inadequate interest among general public
B3 Inadequate funding
C3 Economic evaluation of next project needs to be revised
D3 Decision-making process could be derailed by single-interest groups or remote government bureaucracies
A4 Economic growth paradigm; limit the growth within a watershed
B4 Government participation in and commitment to the consultation process
C4 What is decision-making process?
D4 Attempting to proceed without settling native land claims
B5 Two power rate system
D5 BC Hydro may lose sight of its primary responsibility

Stakeholder Identities

- Individual or group substantially affected by Columbia Basin activities, including policy interests
- individual or group representative who are impacted by Columbia Basin policy decisions
- any person or group whose life or place to live is affected by BC Hydro activity
- a registered resident of the area directly affected by the facilities, such as:

ministries (Provincial and Federal)
communities
industries
BC Hydro
downstream US operations
tourists
local environmental organization(s)
Alpine Club of Canada
special interest groups
commercial interests
aboriginal people
shoreline residents
government agencies
local fish and wildlife people
utilities
consumers

Key Questions Raised

- Resources belong to the province but local people must benefit
- Utilize technical expertise
- How evaluate success of IRM
- Aboriginal concerns and claims

Appendix One

Columbia Basin Discussion Group Format:

Overview: There will be two distinct sections to the workshop. The first half will focus on the **vision we wish to share with B.C. Hydro** while the second will concentrate on sharing advice on how to **overcome the roadblocks or detours on the way to new successes.** Each session will require about forty-five minutes. The theme will be 'A Step Towards Integrated Use,' with reference to the concept of **sustainability**. Sustainability will be used within the context suggested by the Round Table:

> "To aim for sustainability is to aim for balance in our economic, environmental and social goals. The expectations of present generations have to be balanced with the expectations for future generations. The desire for human benefits from resource use has to be balanced with the desire to maintain natural ecosystems." (*A Sustainability Strategy for Energy*, pp14).

Procedures: Upon entering the room, as a participant, you will receive a card from a deck of playing cards; this card will identify your small group for today.

B.C. Hydro staff members Al Geissler, John Irvine, Harold Gruber, Zig Hathorn and Peter Calder will assist by chairing or co-chairing small group sessions on:
Fish & Wildlife,
Recreation and Access,
Debris Clean-up, and
Public Involvement Process.

The Public Involvement group will be chaired by the Session facilitator; Lachlan Russel will be a floating resource person, available to all groups. At least one of the invited representatives from the Columbia Basin community will be in each small group to provide a sense of local perspective and to help serve later as a conduit of information back to the communities.

Each group will examine their topic within the context of the basic assumption that the Columbia River Basin in Canada is a cohesive unit which would benefit from integrated use of resources which rely on water plus the accompanying three questions:

- To what extent should a plan for the Provincial use of Columbia River Basin resources be determined by the people who actually live in the Basin?
- Who should be involved in designing such a resource use plan?
- What are the benefits and costs of integrated resource use, as they relate to B.C. Hydro activities?

Each group will have a principal topic to address; if they complete their discussion within the time limit, they can then move to the next, and so on. The order is as follows:

Group A: a, b, c, & d

Group B: b, c, d, & a
Group C: c, d, a, & b
Group D: d. a, b, & c

Agenda

Welcome and Overview: Delivered by Lachlan Russel, Project Director, CRBOP.

What is the opportunity that the CRBOP provides for effective, dynamic, interactive and inter-stakeholder input into long-term sustainable development? And, why is B.C. Hydro even suggesting this type of theme for the Energy Forum?

Small Group Activities: Part One

Each participant will have five minutes to individually brainstorm as many ideas as possible as to the preferred direction, approach or **vision** that should be adopted by CRBOP towards the particular theme: **where/what ought BC Hydro to be going/doing?** Once completed, the participant should prioritize her/his choices.

After the brainstorm, the chair will ask each participant for their first two choices. Each will be written on flip charts. There will be some opportunity for clarifications. Once everyone has a good understanding of the various visions being put forward, each will be given three preferential labels (1-red, 2-blue, 3-yellow) to place beside the three most desirable directions. These votes will be tabulated and a revised summary sheet will be prepared for general viewing.

Review Highlights of Part One (by the Facilitator)

Help the groups focus further to identify **roadblocks** that BC Hydro may need to be prepared for in attempting to pursue these recommended visions.

Small Group Activities: Part Two

Each participant repeats the brainstorm, this time setting out potential **roadblocks and detours** as well as **opportunities** (how and how not) to achieve the earlier determined targets; once completed, priorities will be established.

The Chair will again ask each participant for their first and second choices. After reviewing the written concerns, participants will preferentially label the three most critical roadblocks, or, if properly dealt with, potential opportunities for realizing the preferred kind of basin planning. These votes will be quickly tabulated and a draft summary sheet prepared for a general review.

Review Highlights of Part Two (by the Facilitator)

This will help ensure everyone is clear on the potential roadblocks, detours and opportunities before participating in the final assessment.

General Session (Facilitator in chair)

The facilitator will verbally review the small group summaries. Every one will be given a set of four green labels to place beside the visions and/or roadblocks on the summary sheets that they feel BC Hydro should consider first in the development of CRBOP.

Once the voting has been completed, a 'Round Room' will be held to make sure everyone has a 10 second opportunity to add a few concluding remarks. The final speaker will be Lachlan Russel

After adjournment, the facilitator will meet with the Columbia Basin reps and BC Hydro chairs for a short session to finalize the type of summary report the facilitator will present to the Tuesday wrap-up session.

Appendix Two

Visions (and their relative rankings, by small group)

Group A

11 Formal Plan be developed & agreed (binding) between all parties
10 Prepare integrated resource use plan
7 Decision-making responsibility on watershed stewardship by balanced local council (all resources)
5 Fish & Wildlife programs developed in public process
5 Manage for bio-diversity of all species simultaneously
5 Power benefits ($$) pay for enhancement and remediation
4 Study of wildlife species
3 Neutral body to manage the process
3 Protect native habitats
3 Restoration of habitats
3 Clean up all debris from flooded areas
3 Protection of all headwaters
2 Maintain an inventory of fish & wildlife stocks and habitats
2 Potential fish enhancement in new environment
2 Monitor environmental impact & report publicly
2 Minimize damage to foreshore areas due to operations (fluctuating water levels)
2 No further hydro/electric developments on the Columbia system
2 Identify all species (fish) present before & replace
1 Enhancement and protection of all native fish & wildlife species
1 Coordinate protection and enhancement pro grams with U.S. operations (BPA)
1 Initiate a sound monitoring system for fish & wildlife

Others:

- zero loss of old growth habitat
- coordinated harvest management programs
- plan decommissioning during initial design
- zero chance of fish & wildlife habitat loss
- manage wildlife on land use capability basis
- minimize interference with native habitat

Group B

15 Basin-wide integrated resource management planning process
8 Better coordination between stakeholders
8 Residential point-of-view
6 More information on expected operating ranges
6 Better funding arrangements for operations & maintenance
4 Preserve key alpine access areas
4 BC Hydro to assist recreation but others to carry out the responsibility
3 Replace lost opportunities
3 Restrict access where wildlife is threatened
3 Stakeholder advisory committee
2 Restore original aquatic conditions as nearly as possible
2 Community pride in the facilities
2 Ten feet (3 metre) limit on reservoir fluctuations in season
1 Zero debris on the reservoir lakes
1 Do not allow access in most sensitive areas
1 Integration of fish stocks into reservoirs

Others:

- direct construction activities to assist recreation
- develop more lakeside campsites
- exercising & demonstrating stewardship
- extensive reservoir boating facilities
- shoreline restoration to lower water level
- provincially controlled tourist promotion
- consultation with actual recreation area users
- roads to lowest drawdown level
- coordinated survey of recreation sites
- better management for resident fish stocks

Group C

12 Total integrated resource management
8 Establish a cooperative process to manage inter-dependency of resource & community interests
6 Joint debris management with other stakeholders
5 Do not build Murphy & Border (dams)
4 Seek effective PIP (public involvement program)
4 Improve recreational facilities and disseminate relevant information
3 Deal with direct impacts and not just water licence requirements
3 Workshops to understand system integration (USA/Canada)
3 One paper which outlines system operation - reservoir levels, debris, wildlife, etc.
3 Fifty percent (50%) local ownership of new facilities
3 Review inter-utility integration coordination
2 Fish & wildlife back to pre-construction levels
2 Public Involvement in DSM discussion and disposition
2 Utilize youth on all enhancement work as post-secondary employment
2 Public awareness province-wide of impacts
2 Do not further impact the Peace-Athabasca delta
1 Spend resources to enhance economic development
1 Recreation & access consistent with expressed needs

Others:

- habitat enhancement (hatchery construction)
- fish ladders at all facilities
- do not build Kootenay diversion
- inventory all debris coupled with a management plan
- maximize recreation opportunity (high or low water years)
- integration **not** accommodation
- BC Hydro to get involved in the entire Columbia River Basin (USA & Canada), including pollution in the river

Group D

11 Independent, comprehensive,province-wide study of **all** options available for generation of needed power. Give real examples and their impacts.
11 Stakeholders Round Table to direct basin management
6 To explain what BC Hydro actually has responsibility for
6 To strike a balance between local property rights and export markets (domestic & international)
6 **Full** cost accounting of all downstream US benefits that don't offer a return on investment to Canada
5 Aspects of planning (various resources) organized by someone other than BC Hydro, who would just be a participant
5 Community partners on **policy-level steering committee**
4 To outline potential generation remaining for the Columbia Basin
4 Comprehensive planning for a new non-treaty storage agreement
3 Local mitigation of environmental interventions
3 Legislated review for new projects to include stakeholders and their expenses
3 Develop hydroelectric capabilities to the fullest
3 A province-wide info system that explains the province-wide implications (energy for all)
2 Accept concept of sustainability, as defined by B.C. Round Table, in all energy planning

Others:

- group must have trust and sincerity of who they do plan for
- to enhance forest resources of thebasin
- to include recreation
- keep public well-informed
- free movement of energy resources to where they are most wanted

Roadblocks, Detours and Opportunities

Group A

13 Research into biological systems paid for by power benefits

9 Lack of thorough understanding of biological systems
7 Inadequate interest among general public
6 Economic growth **paradigm** – limit the growth within a watershed
3 Focus on **all** communities not just the big and powerful ones
3 Design process locally
3 Use and pay for local information
3 If voluntary, then all interests may not be represented
3 Inadequate public information on programs
2 Process determined from outside
1 Time/complexity of government processes
1 Trying to get financial participation from local groups

Others:
- Council, when formed, undertake + take ownership of **studies**
- Use studies/experience from other jurisdictions
- Innovative means (e.g., electronics) of voting for public-at-large
- Existing processes need to be replaced (bureaucratic inertia)
- Short time-frame
- Lack of adequate funding
- Inability to predict climate —> unfulfilled expectations
- Need to establish who should be involved
- Difficult to obtain equitable (per capita) representation by active participants

Group B

15 Confusion of roles and responsibilities
10 Decision processes to integrate multiple values
6 Inadequate funding
6 Government participation and commitment to consultation process
6 Two power rate system
4 Operating reality versus user expectations
3 Inter-agency competition
3 Getting environmental consensus
3 Getting the right participants and agencies
3 Consultation by exhaustion
3 Good leadership
2 Political pressure for a **quick fix**
1 Industry versus conservation conflicts

Others:
- Resistance of local people to planning
- Inadequate information base on which to make decisions
- No regular coordinated feedback process
- Hidden agendas
- International aspects
- Community should direct stakeholder process
- Anticipate effects of climatic change
- Land ownership conflicts
- More operating advisories
- Identify process lead and concepts
- Establish stakeholder accountability

Group C

21 How do you place a value on environmental resources; what is the relative value?
13 Who makes the decision?
10 Economic evaluation of next project must be revised
7 What is the decision-making process?
5 How to apportion a resource across the defined needs
4 All be given equal resources consideration
2 How do we define needs for the resources
2 Jurisdiction: corporate and/or agency mandates
1 Competing interests (US interests possibly compete with domestic interests)
1 What does integrated resource management really mean?

Group D

13 Columbia River Treaty and non-treaty storage agreements
9 NIMBY attitude – "not in my back yard"
8 Decision-making process could be **derailed** by single-interest groups or remote government bureaucracy
7 BC Hydro may lose sight of its primary responsibility
7 Attempting to proceed without settling aboriginal land claims
5 Rationalizing needs & wants of the larger community with those of local peoples
5 Building trust and developing credibility with the public in the process
4 Lack of ecological understanding
3 Inadequate intervenor funding makes discussions lopsided
3 Misinformation by media adversely affects public opinion (KISS – Keep It Simple, Stupid)
2 Unresolved forestry and land use conflicts

Others:
- Flexibility of plan to change & evolve in time
- Government hidden agenda thrust
- Mindset and history of development of Columbia Basin for power
- All new provincial environment Acts and Regulations
- Establishment of a mandate for Integrated Resource planning
- Nurture an open and honest working environment (pro-active)
- Non-stakeholder lobbyists
- Reaching consensus among stakeholders
- Follow through on implementation (leadership & resources)

Electricity Trade Discussion Session

1. **Introduction**

The discussion session on Electricity Trade: Ben-

efits and Costs was held on Monday afternoon. It proved to be one of the most popular of the discussion sessions of the Forum, with a large audience that included representatives from industry, government, environmental groups and the general public.

The session was facilitated by Moira O'Neill of O'Neill and Associates, a Seattle-based consulting firm specializing in energy issues. The format was of relatively unstructured and free-ranging questions for the audience, with a previously distributed discussion paper serving as the background. Participants' opinions on various topics were tabulated as they were expressed.

To help summarize the session, it was broken down into the four different opics that developed:
Benefits and Costs,
Export Restrictions versus 'Good' Exports,
Electricity as a Commodity, and
Comparing Export Projects.

Under each heading, the recorded comments of the participants are listed, followed by a short analysis of the discussion.

2. Benefits and Costs

Benefits

- revenues (from export sales),
- new market opportunities (for our natural gas supplies),
- environmental benefits (hydroelectricity displacing fossil fuels),
- system optimization (efficient use of surplus electricity),
- employment (any future facilities built for long-term export),
- flexibility (access to an interconnected utility system),
- anti-isolationism (trade with the U.S.),
- 'fish flush' (surplus water used to help fish populations), and
- tax revenues (on any new facilities built for export).

Costs

- environment (changing reservoir levels),
- new facilities (development/operation impacts),
- low prices (not getting good value for exports),
- hurt conservation ("conserving energy to sell to the U.S."),
- exporting jobs (jobs created in the U.S. by exporting water or power),
- Free Trade Agreement implications (impinging on our sovereignty),
- lost tax revenues (from lost jobs, etc.),
- 'fish flush' (surplus water used for U.S. fish at our expense), and
- flexibility (U.S. operational flexibility impacts our system).

The discussion began with attendees expressing their general opinions on the overall benefits and costs of electricity trade, with no distinction made between the different activities that fall under the electricity trade umbrella, although it quickly became obvious that interest centred on export sales. As can be seen from the above list, there was a wide range of opinions on both sides, and it should be noted that there was no general consensus. Two aspects of particular interest were:

(a) All the benefits/costs put forward had previously been identified by BC Hydro/POWEREX in prior research and consultation;

(b) A number of factors, such as environment, employment and tax revenue, appear on both sides of the benefit/cost ledger.

3. Export Res[illegible] versus 'Good' Exports

Export Re[illegible]ons/Concerns

- new facilities (development/commitment solely for export),
- revenue use (for research/new technologies),
- environment (criteria need to be set and adhered to),
- full cost accounting (all costs must be factored into transactions),
- negotiation restrictions (on IPPs prior to project approval),
- regional input into decisions,
- resource control (regarding the Free Trade Agreement),
- hydro project restrictions (development/operations),
- price (ensure a real profit is made),
- financing (economic responsibility for expensive projects), and
- terms of contract (long- versus short-term).

'Good' Exports

- four year term (normal planning cycle),
- competitive market (guarantee fair deals),
- opportunities for natural gas through export IPPs,
- 'real' exchanges (equal amounts and conditions), and
- imports part of electricity trade (help flexibility and efficiency).

The discussion then turned to a comparison of concerns about and restrictions needed on electricity trade with what were loosely classified as 'good' export activities. There was once again a wide range of opinion on this topic and a similar lack of consensus about the contents of either list. Of notable interest here was the attention given to such issues as full-cost accounting, the implications of the Free Trade Agreement and the construction of new facilities specifically for export. On the other side of the debate, a number of free-market advocates rejected the need for any limitations on electricity trade and some in the natural gas industry expanded upon the opportunities for their resource.

4. Electricity as a Commodity

Electricity 'Differences'

- Columbia River Treaty (regulations for both U.S./Canada),
- more valuable commodity,
- land use (impacts),
- time/how to produce,
- public funds/cost,
- only a 'currency' (means to an end), and
- how it is used.

By this time, it was apparent that electricity was being characterized and valued differently by participants, which in turn was affecting people's opinion of how it should be traded. The above list indicates that some people perceived that there was a 'uniqueness' to electricity. A number of people, however, felt that electricity was no different than other trading commodity.

5. Comparison of Export Projects

Hydro

- environmental impacts (development and operation), and
- economic risks (financing for mega-projects).

Woodwaste

- actual waste being used (secure supply), and
- fewer environmental impacts (help local air quality).

Natural Gas

- better for environment (compared to other fossil fuels),
- low emissions/high efficiency,
- co-generation further increases efficiency,
- non-renewable resource,
- abundant supply,
- market security (how table is the market), and
- term of benefits (how long with the benefits last).

Alternative Energy

- use instead/develop for domestic purposes, and
- demand side management (DSM and conservation programs).

The final topic was the feasibility/acceptability of building projects specifically for the export of long-term firm electricity. The subject lead to a vigorous discussion of the costs and benefits of project different categories, including hydro, woodwaste, natural gas and alternative energies. There was also interest in possibly developing such projects for domestic requirements, to push back the need for more traditional mega-projects.

6. Conclusion

The session concluded with a short response from POWEREX President and CEO Ken Epp, in which he first commented on a number of the positions put forward during the discussion and then thanked the group for its participation and input.

The discussion session succeeded in its goal of bringing about a constructive dialogue on a very emotional subject. As well, the background information prepared for the session seemed to be accepted by all as a balanced approach to this topic. Finally, it also set the stage for the next step, a more focused dialogue on specific aspects of electricity trade.

Planning and Choices Discussion Session

Portions of this report were transcribed from notes and summaries written by other people attending the Planning and Choices Forum Workshop. They were:

Mary Scott, Inter Facts Consulting
Julie Paul, ARA Consulting Group
John Forsdick, Context Consulting
Helen E. Popple, B.C. Hydro
Cindy Papso, B.C. Hydro
Marianne Field, B.C. Hydro
Dave Thompson, B.C. Hydro
Bruce Prossack, B.C. Hydro

1. Background

As part of an ongoing effort to develop an inclusive planning process for electricity, B.C. Hydro sponsored an afternoon session at the 1992 Energy Forum designed to solicit feedback on electricity planning from participants. The goals of the process were to:

- Provide ideas and suggestions on electricity planning,
- Explore public involvement in electricity planning, and
- Develop means to involve the public in electricity planning.

2. Session Organization

More than 50 people attended the afternoon session on May 11, 1992. After a brief introduction on planning and an identification of the objectives, participants were invited to separate themselves into 4 groups covering 3 topics. These topics were:

A. Community and Regional Planning: A Square Peg In A Round Hole (8 participants).
B. The Public's Role in Electricity Planning: Empowerment or Alienation? (17 participants).
C. Building and Electricity Plan: Cold Rooms to Cold Fusion (16 participants).

Due to a very high response for topic B, 2 groups, one of 8 participants and one of 9 participants, were formed to cover the topic.

Participants took their places at 4 tables set in the corners of the meeting room and each group was facilitated by a moderator. Notes for each group were taken by a designated recorder.

The two hour discussion was generally lively and spirited. At its end, a member from each group was selected to bring the results to the entire group and participants were encouraged to complete a session

evaluation form. All participants then regrouped to hear the brief summary of the results from each of the small group sessions.

3. Feedback

Based on the Feedback and Information Forms, reasons for participating in the groups fell into three areas. First was a professional interest in the planning process, followed by a desire for input into the planning process. To a lesser extent, some participants had previous experience with the planning process and wanted to share some of their knowledge within the context of a working group.

- 87% of the respondents rated the Planning and Choices session as worthwhile and were pleased that BC Hydro wanted to discuss planning and choices with people not necessarily employed in the energy field.
- 72% said that they had increased their awareness of community and regional planning processes and a higher percentage (87%) said that their awareness of public involvement had increased.
- At the same time, 68% of the respondents indicated that they had expanded their personal perspective on their chosen topic.
- 90% of the respondents felt that the facilitator's style was average or better.
- 61% of the respondents rated the planning and choices session as good or well received, 11% rated it as 'super' and 22% thought the Planning and choices session was interesting but slow. Only 6% of the participants rated the session as 'boring.'

Nonetheless, there were numerous complaints about the time allotted to the topic; most participants felt that the topic matter deserved a full day of discussion. In addition, participants also found the indefinite nature of the topics somewhat confusing and would have liked to have had a reminder of the discussion objectives put before them. A few respondents noted that the noise level in the room constrained their ability to listen and speak effectively.

Participants noted that some issues were not discussed enough at the sessions. These included:

- Global concerns, and
- A more in-depth explanation of electricity planning in general.

Alternative Energy Discussion Group

1. Introduction

We would like to thank all those who took part in the Alternative Energy discussion and in particular the table facilitators and Dr. Bob Evans, the discussion group facilitator, for the excellent job they did.

To improve the discussion, we tried to ensure that there was a diversity of opinions at each table; we hope that this arrangement worked to everyone's satisfaction. We are pleased with the results. The hard work of the participants has given us some very useful ideas and rankings with which to assess B.C. Hydro's role in alternative energy R&D.

2. Objectives

The objectives set out for the discussion group were as follows:

1. To have each person examine and express their views of the pros and cons of alternative energy technology.
2. Examine the role of the utility in developing alternative energy technology and in encouraging the growth of alternative energy generation in its jurisdiction.
3. Reflect on the impact which alternative energy technologies could have on rates.

To achieve these objectives, the participants were asked to rank the alternative energy technologies in order of importance, based on their own experience. Each table then presented the results of their collective ranking.

3. Procedure

A sheet listing unit energy costs for electricity generation from alternative energy technologies was then distributed. These estimates are based on present day typical costs. There are lower cost producers, but these estimates are representative considering B.C. conditions.

The delegates were then asked to re-examine their list of priorities for alternative energy R&D and revise their list based on the cost information.

The delegates were also asked to examine the proposed alternative energy strategy scoping document and suggest how it could be improved.

Each table then presented the results of its discussion. The results from the table facilitators were then presented to the discussion group by Dr. Evans.

In the groups, discussion was not limited strictly to research and development (R&D), but also included demonstrations and commercialization. The following criteria for ranking alternative energy R&D projects were developed by the participants.

4. Criteria for Ranking Alternative Energy R&D Investments

1. Solving a waste problem
2. Environmental impacts of generation, including social impacts
3. Land use
4. Potential generating capacity from the proposed technology
5. Employment creation

6. Centralized versus decentralized supply of electricity
7. Reliability of the electricity supply
8. Proximity to load centre
9. Status of the technology - R&D versus proven
10. Avoided cost - location relative to load, minimize capital and risk
11. Sustainability of the energy resource
12. Lead time to develop the new generation

The following initiatives were recommended in response to a review of the alternative energy strategy scoping document.

5. Alternative Energy Technology Promotion Initiatives for B.C. Hydro

1. Prepare an inventory of potential resources - two tables
2. Finance small operators both on and off the grid
3. Coordinate R&D with other jurisdictions
4. Take advantage of resource strengths within B.C.
5. Employ full cost accounting, ie., include environmental impacts (chosen by two tables)
6. Fund private R&D to encourage the research
7. Prepare a statement of commitment to a plan for alternative energy R&D and adopt a budget which reflects a serious commitment
8. Report to the Forum each year on progress and spending on alternative energy R&D
9. Initiate demonstrations to implement new technologies
10. Use public involvement and education to promote alternative energy technologies
11. One person noted that B.C. Hydro should issue a Request for Proposals for generation from alternative energy technologies
12. It was suggested that B.C. Hydro subsidize alternative energy generation in the way that those using diesel generation are subsidized.

The alternative energy technologies were ranked in order of priority for R&D investment. On-grid and off-grid applications were lumped because we were concerned about the best technologies for R&D investment regardless of whether the technology would be used on or off-grid.

6. Results

The results have been divided into short to medium term and medium to long term applications. The top 3 choices were selected from each table and points were awarded (1-3) based on each table's priority. The ranking of the alternative energy technologies were tabulated as follows:

Short-Medium Term		**Medium-Long Term**	
Wind	13	Fuel Cells	16
Wood Waste Thermal	12	Municipal Solid Waste*	10
Small Hydro	9	Solar	7
Solar	3	Wood Waste (gasification)	2
Municipal Solid Waste	2	Waves	2
Geothermal	2	Small Hydro	2
Fuel Cells	2	Geothermal	2

* One table recommended the use of methane gas from landfills. It was not clear if this proposal was for development of the use of landfill gas or if the proposal was for the development of gasification of municipal solid waste.

Tidal generation was also identified, but as a technology of less importance for R&D funding. Rare earth magnets was an innovative generation technology identified by one of the tables as deserving of R&D funding.

Wind can be used for on and off-grid applications and should have a high priority for demonstration projects. It was recognized that a wind resource assessment and site evaluations are required, but that there can be problems with noise and visual impact from this form of generation.

Wood waste thermal (hog fuel-fired) power generation emphasizing co-generation to improve efficiency was identified as having significant additional potential for on-grid applications. Wood waste thermal could be developed by private industry. The use of wood waste for power generation would reduce smoke (particulates) from incineration. In addition, wood waste is sustainable, does not contribute to global warming, is presently wasted and could provide short- and long-term employment. Wood gasification technologies could also be developed.

Small hydro can be used for on and off-grid applications, but additional site investigations are required and demonstration projects should be given a high priority. However, the technology is proven and costs of generation are already economic. There may be impacts on fish as a result of specific projects.

Municipal solid waste (MSW) is a sizeable resource which can be used for on-grid applications, but emissions require scrubbing and ash disposal can be a problem. It was felt that this technology could be given a low priority for demonstration projects in the mid-term.

Solar can be used for off-grid applications and should have a high priority for demonstration projects.

Fuel cells can be used for on- or off-grid applications and should have a high priority for mid-term applications. At present, costs restrict their use.

Geothermal can be used for on-grid generation, but it is proven technology with very limited potential in

B.C. As a result, geothermal has a only a low priority for demonstration projects in the mid-term.

Tidal and waves should have on-grid applications and a high priority for R&D in the long-term.

The point was made that the present costs of fossil-fired generation do not reflect externality costs and the fact that they are non-renewable. Legislation similar to PURPA should be implemented. Profits or taxes from non-renewables should be used to support R&D, demonstrations and commercialization of renewables.

Public Involvement Discussion Session

1. Introduction

Energy projects and initiatives are increasingly the subject of public discussion and input prior to their approval. In B.C., for example, the proponent of any new electrical generation facility of greater than 20 MW capacity has to address public concerns as part of the Province's Energy Project Review Process.

At its best, a public involvement process improves communication, resolves differences and builds public support. At its worst, it is used with the intention of manipulating, blocking or exhausting other parties.

Even with the best of intentions, not all public involvement initiatives are successful. Results can fall short of expectations and produce residual feelings of frustration and failure.

Clarity of intention and appropriateness of the process are two of the critical ingredients in creating successful public involvement. The opportunity to explore these and other key issues was the focus of this session. It was also meant to explore the degree to which there was agreement or disagreement among participants on the questions raised.

Prior to the Forum, a discussion paper entitled 'Public Involvement: Advancing the Dialogue,' written by Nancy J. Cooley of Cooley/Olson Inc., was circulated to participants. At the session itself, participants met in small groups and discussed key questions on public involvement in the context of three generic cases. They were then polled as to their views.

As an alternative, participants had the option of meeting in a group with a facilitator to raise and discuss any public involevement topic of mutual interest.

There were about 40 participants at the session. Half chose to discuss the cases and half met in two 'open topic' groups. The outcomes of those two activities are summarized separately below.

2. Case Discussions

2.1 New Facilities

Two of the cases were similar in that they concerned new physical facilities; one was an independent power facility tied to a new waferboard mill, the other was the upgrading and rerouting of a transmission line. The outcomes of these two cases are considered together.

Participants were asked and responded to the following questions.

What questions should be considered by a public involvement process on this issue?

A clear theme among the responses was the need to review the project's justification and all of the possible alternatives, including conservation. Another was the need for full cost accounting for the independent power facility.

Who should participate and at what level?

'Level' refers to the degree of involvement. In the discussion paper and at the session, the possible levels were defined as follows:

Advisory: The sponsoring organization asks for information and opinions from those who are involved and generally seeks to share information as well. At this level, the sponsoring organization undertakes to listen but makes no promises to follow the advice it receives.

The sponsor will not share any of the decision-making authority.

Consultive: The sponsoring organization seeks a dialogue and understanding with those involved. It undertakes to follow the advice it receives, if possible, and to explain its decisions to those providing the input.

The sponsor will share some of the decision-making authority.

Participatory (or collaborative): The sponsoring organization undertakes to reach mutually agreed decisions, if at all possible. The dialogue continues until such time as agreement is reached or it becomes clear to all parties that agreement will not be reached.

The sponsor shares a substantial part of the decision-making authority.

Delegative: The sponsoring organization indicates to an identified group(s) that it will accept whatever recommendations come forward.

The sponsoring organization authorizes another agency to exercise its decision-making authority.

For these two cases, it was generally agreed that:

- Organizations and individuals whose central interests or concerns are significantly affected by the decision should **participate**.

- Organizations and individuals whose interest are somewhat affected by the decision should be **consulted**.

Any individual or organization that wishes to become involved but whose interests are not directly affected by the decision should be **consulted or allowed to advise**.

How should individual participants be selected?

A list of possible participants was provided together with a number of methods by which participants could be selected. There was a strong bias in favour of participants being self-selected or being selected by a group or number of groups to speak on their behalf. Selection of participants by the sponsor of the public involvement process or by the project sponsor was not generally favoured.

What is your ballpark estimate of the amount of time involved and the total cost of a useful public involvement process in this case?

Time was defined as the total number of days required for participants to prepare and participate, any studies to be prepared, and the administration of the public involvement process.

Costs included the total value of all people's time (paid and unpaid), communications, publications, travel, meeting room rentals, etc.

The estimates of the amount of time were in the range of 100 to 250-plus days for this kind of public involvement exercise. Costs were in the range of $50,000 to $250,000.

During the subsequent discussion, it was noted that for most participants these were simply guesses, as they had had little direct experience of costing public involvement activities.

What would constitute a successful outcome?

Agreement that concerns had been addressed was the most frequent response.

2.2 Ethic Change

British Columbians are generally supportive of conservation and see conserving electricity as a way to help protect the environment. Residents also believe that they are currently conserving electricity while, in fact, they are some of the world's highest per capita consumers of electricity. Clearly, in order for there to be significant voluntary conservation there needs to be a shift in public attitude and behaviours.

The third case was concerned with the question of whether B.C. Hydro should be endeavouring to change its customers' attitudes and, if so, how. The responses were as follows.

Should there be a public involvement process in this case?

The answer was 'yes.'

What questions should be considered by a public involvement process on this issue?

Responses included the question of B.C. Hydro's mandate, strategies for creating ethical change, and the focus of any grassroots, regional or provincial program.

Who should participate and at what level?

Most people felt that organizations and individuals whose central interests or concerns are significantly affected by the decision should **be consulted or should participate**.

It was noted in subsequent discussion that it was difficult to think of anyone within B.C. who did not fall into that category.

How should individual participants be selected?

In contrast to the other two cases, invitation by the project sponsor was seen as the most appropriate way to select participants.

What is your ballpark estimate of the amount of time involved and the total cost of a useful public involvement process in this case?

This public involvement process was seen to be bigger than the other two cases. The estimates of time were in the range of 250 to 1000-plus days while costs were in the range of $100,000 to $500,000-plus.

What would constitute a successful outcome?

The overall response was that an agreement to proceed or not proceed with an ethics change program, together with a strategy to foster a feeling of 'ownership' by diverse interests, would be a successful outcome.

3. 'Open Topic' Discussions

The summary provided below is a transcription of the flip charts used to report the discussions of the open topic groups to the other participants in the session. Necessarily, such a summary does not capture the full range and depth of discussion.

Group 1

Topics raised by this group were:

- methods to properly inform and involve the public,
- resolving differences in energy arena between

public interests and industry,
- psychology of public involvement,
- who is the public? What should be the extent of the public's involvement? What issues should be brought forward?
- how to involve stakeholders?
- identifying new ways of public involvement,
- ensuring local public concerns are adequately reflected in final result,
- costs of public involvement activities,
- raising awareness of individual responsibility with respect to energy consumption, and
- recognizing differing global living standards and the use of public involvement for global benefit.

Discussion of the topic "How to properly involve the public" led to the following conclusions:
- there needs to be early communication of specific expectations by both industry and the public,
- all agendas should be on the table,
- 'success' needs to be defined for both the process and its outcome; it is helpful to be working towards a vision,
- underlying everything is the need to **build trust,**
- there is a need to built awareness of the importance of individual responsibility and the values the public currently has regarding energy consumption. It was also noted that the definition of 'public' can be problematic.

Group 2

Topics raised by this group were:
- habitat and ecosystem,
- public perception versus corporate rhetoric,
- lack of public awareness of long-term goals,
- 'group think;' preconceived agenda restricting the free flow of information,
- government manipulation of corporate agendas,
- paradigm of social process limits relationships of human/ecology value,
- balance of local issues with societal interests,
- facilitating communication between corporations and the public,
- clear indication of cost of implementation of project whether environmental or expansion of service, and
- where do profits go? Back into improving system or to general revenue?

Discussion concentrated on the topic "facilitating communication between corporations and the public." The following points were noted:
- the need to establish credibility; there was often some historical 'baggage' to be overcome,
- public interest has to be created,
- it is important to use appropriate processes; an independent facilitator can be helpful,
- how is information developed? It is important to include both heart and mind,
- stakeholder groups sometimes lack an invitation or funding,
- a 'win-win' solution is not always possible,
- how to balance self- versus public (or global) interests? and
- non-human (wildlife and habitat) issues must be addressed.

4. Conclusions

The high level of engagement during the session indicated that the discussion group was serving its purpose in providing participants the opportunity to address issues in the area of public involvement.

Several participants commented on the lack of time to do justice to the topics raised. This suggests that it would be desirable to provide opportunities for further dialogue of this nature.

B.C. Round Table Discussion Session

Reported by Michael S. Price, of the B.C. Round Table on the Evironment and the Economy.

Participants were asked to focus their discussion on the following chapters of the B. C. Round Table document entitled *Sustainable Strategy for Energy*:

Chapter 1: Introduction;
Chapter 2: Global Warming;
Chapter 3: Energy Efficiency and Conservation;
Chapter 5: Energy Pricing; and
Chapter 8: A Sustainable Energy Future

Topics addressed in the remaining chapters of the Report, such as Alternative Energy, Energy Exports and Energy Planning were dealt with by other groups.

Overall, *A Sustainability Strategy for Energy* was well received by the four working groups that discussed the individual chapters. There were, however, several common criticisms of the *Strategy*, ranging from 'recommendations are too general', 'more examples needed', to 'requires more specific targets and schedules'.

On Chapter 1: *Introduction*, there was general agreement with the types of questions raised around the Round Table's sustainability principles. However, there were numerous comments to the effect that the strategy could not be considered complete until it dealt with transportation energy issues. It was explained by Round Table staff that this major topic would be dealt with in a subsequent strategy document on Sustainable Communities and Transportation.

On Chapter 2: *Global Warming*, there seemed to be recognition that the phenomena was occurring but there was considerable discussion as to the timing and severity of problems that would arise as a result of increased global warming. There was a call for British Columbia to provide assistance and exert pressure nationally and internationally to move towards a global strategy for CO_2

control and management. It was also stated that we should increase our knowledge of British Columbia's ecosystems (CO_2 sinks) and move to protect more of these. Peat bog conservation was cited as an example.

On Chapter 3: *Energy Efficiency and Conservation*, there was considerable discussion of the types of programs and standards in B. C. and in other jurisdictions. An expansion of B.C. Hydro's Power Smart program was suggested along with a parallel initiative that would cover non-electrical forms of heating. Also discussed was the contribution to conservation and efficiency that the 'three Rs' (reduce, re-use and recycle) can offer. It was suggested that legislation on packaging and recycled content be put forward.

On Chapter 5: *Energy Pricing*, there seemed to be a consensus that the chapter contained the right type of recommendations. There was discussion on who should pay for environmental costs and whether or not pricing was actually an effective means of altering behaviour.

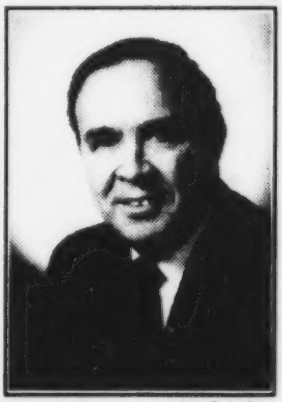
On Chapter 8: *A Sustainable Energy Future*, there was very little discussion. There was more interest in discussing aspects of *Energy Exports* and *Energy Planning*. A public review process for energy exports was suggested, and that intervenor funding be made available for non-government organizations.

John Allan: It is now my pleasure to introduce to Dr. Stan Hatcher, President and Chief Officer of Atomic Energy of Canada Limited. (AECL). He was formerly Head of the Chemical Technology Branch and Director of the Applied Science Division of Whiteshell Laboratories. He also served as AECL's liaison officer at the United Kingdom Energy Authority. Dr. Hatcher is Vice-Chairman of the Pacific Nuclear Council and has served on committees for the Pacific Basin Nuclear Conferences in Vancouver, Seoul, Beijing and San Diego. As well, he is a Director of the Canadian Nuclear Association and Vice-Chairman of the Energy Council of Canada.

Please welcome Stan, who'll wrap-up the Forum.

Conference Summary

Thank you, John. I am here more as the Vice-Chairman of the Energy Council of Canada (ECC) than as the President of AECL. So let me say up front for the Energy Council of Canada, that, in our view, the ultimate purpose of Energy Forum '92 is to help us prepare a Canadian position for the World Energy Congress in Madrid this September.



1. Energy Forum '92 is Valuable Input for the Madrid World Energy Congress

The Canadian position will be based on key points that arise from presentations, panels and discussions at Forums just like this. The Canadian contingent will carry that position forward to Madrid in September. We take seriously our mandate to promote discussion on all forms of energy and to forge a better understanding of energy matters between the private, government and public sectors.

And of course as you all know this year, we had the benefit of doing all of this in conjunction with B.C. Hydro's Fifth Electric Energy Forum and I believe that we've all profited from that collaboration.

2. The 'Architecture' of the Global Energy System

At the Forum we've heard a lot about the concept of what some people call the 'Architecture' of the global energy system. In other words, what are all of the inputs and impacts of the various phases in an energy chain. In line with that, I've attempted to create something of a systems approach to my summary. The end result of this will be a series of challenges which I will be formulating.

Let's look at the architecture of my summary, as shown in **Figure 1**. As you see, I have linked the Energy Council of Canada stream, the Electric Energy Forum program including the just-completed Energy Network Report, and what I have called external inputs, for example from luncheon and dinner speakers, so that we can generate a series of challenges which I hope will lead to a stimulating discussion and some subsequent action.

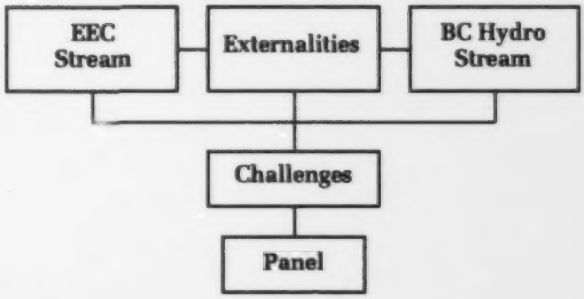


Figure 1: Architecture of Energy Issues

3. Key Issues

Obviously, because of the time contraints, I can't cover all of the sessions of the last two days in detail. I won't even attempt to cover the report that you've just received from the workshops. I'll limit my summary to what struck me as some of the Forum's highlights.

On Monday, some of the key issues that were raised dealt with energy futures, particularly in a global sense; population, the developing countries and the energy needs that flow from that, continuing a dialogue that we started at the Canadian National Energy Forum last year and with the addition of some behavioural aspects. I must stress the critical importance of strategic thinking in addressing these future challenges. The

prospect, as we have heard yesterday and we are hearing more and more frequently these days, is of a world in the middle of the next century with a population exceeding 10 billion people. Even if we adopt heroic energy conservation measures in countries like Canada, if the developing countries are going to have even a chance at a good standard of living, the world will still be consuming twice as much energy then as it does today.

We know that fossil fuels are still going to account for the majority of that energy. There will be some contribution from biomass, hydro and renewables which might make up perhaps 20 per cent of the total energy picture. The only other proven source that we know of today is nuclear, and obviously I believe that is going to have to play a role.

This comes back to a point that several of the speakers made yesterday. There is no simple single answer to the whole energy question. We are going to require all of the energy resources that we can put to work to meet the global needs. In the scheme of things, although we are looking at a global situation, local initiatives are obviously very important, and I think we have to pursue those in the light of this global challenge that I have just described to you.

If you just try to fix your mind on the global challenge, it is almost overwhelming. There is a common saying, which came about in the last couple of decades, of 'thinking globally and acting locally' and I really believe that's what we have to do. We've seen a lot of examples at this Forum of some actions in that light.

Of particular interest to me, because of the global connotation, was the introduction of the concept of the Global Energy System and the clear need for a fully integrated analysis, or, as some people call it today, full-cost accounting, to meet the demands for energy services, while managing the tough environmental issues and the stresses that arise from the use of any energy source. I emphasize that focusing on the provision of energy services is critical. I think this whole energy concept, or full-cost accounting, is an important concept and should be part of Canada's message to Madrid.

Another intriguing topic was how do we measure energy efficiency and how do we improve it? We heard of a number of initiatives, both technical and social, on energy efficiency. We heard of the promise of technology and what can be delivered to the energy system.

Today, on Tuesday, we had a thought-provoking presentation from a First Nations perspective and we had a close look at the B.C. Collaborative Committee process for estimating the potential for energy conservation.

In the discussion groups, there was more on the B.C. Round Table and the collaborative process. I sat in on the group on public involvement, and it further convinced me of the need to build up that process.

4. Conclusions

In conclusion then, let's look, in more detail, at the challenges that came to me out of these two days of deliberations. We have seen that the complexity of meeting the world's needs for energy services and managing the associated environmental stress calls for a total systems approach. This is the basis for the development of what was called the 'Architecture' of the global energy system.

I think one of the first questions that we might look at from a local perspective now is to address that global question:

How can energy policy in western Canada contribute to developing such an integrated or full- cost accounting of the global energy system?

As I indicated in the panel discussion on efficiency yesterday, it is important to differentiate between energy intensity, energy efficiency and energy conservation. They represent to me, at least, three quite different concepts. In the Forum we focused on how energy efficiency can contribute to our global competitiveness and that is a topic of great personal interest to me.

So I would pose the second question, which is:

How can we remove barriers to encourage energy efficiency and so enhance Canada's competitiveness?

We've heard a lot about involving the stakeholders and how that leads to commitment. We see B.C. Hydro actively using that concept here in their discussion workshops and Bob Jamieson alluded to its practical success in the B.C. Round Table on the Environment process. And at lunchtime, we heard from the Honourable Anne Edwards about the new B.C. Energy Council.

So let me then pose the third question:

How do we focus stakeholder input on that overall architecture of building our energy system?

By looking at the whole system, not just the individual components, but the entire system. We heard, at lunch, how trading energy has been a key element in the development of western Canada's economy. We have seen the importance of that both in the Energy Council of Canada stream and the Electric Energy forum.

So that brings me to the fourth question:

How do we balance continuation of direct energy trade, increase trade in energy-intensive products like, for example, aluminium which we export; how do we balance all of those against the environmental costs?

Efficiency, Trade, and the Environment were the major topics of Energy Forum '92. We have discussed at some length the technicalities of these topics but it's

people interacting with people that will really make it happen. Let me finish with a few more words on that collaborative approach to decision-making with particular reference to energy decisions.

I have been personally convinced for some time that this, in many ways, has to be a key to the future and it is very encouraging to see B.C. Hydro leading Canada in some applications of that. In the nuclear industry, we too are trying to build an understanding with the many publics involved through a dialogue with them and I have personally been involved with some ongoing discussion with non-industry groups, such as labour unions and the churches.

From the Forum we have seen that the major energy and environmental challenges of the future are challenges that are critical to the well-being of all mankind. We need some strategic decisions urgently to address those challenges, and I firmly believe that those decisions must be managed by a collaborative process involving all of the stakeholders.

Thank you.

John Allan: Thank you very much, Dr. Hatcher.

Panel Discussion
Energy Development in Canada: Where Do We Go From Here ?

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Marc Eliesen is Chair and Chief Executive Officer of the Ontario Hydro Board of Directors. Previously, he was Ontario's Deputy Minister of Energy, Chair and Chief Executive Officer of the Ontario Energy Corporation, and served on the Suncor Board of Directors. Mr. Eliesen has held various positions with the federal Departments of Finance and Industry. In both British Columbia and Manitoba he has served as Deputy Minister to the Premier and Planning Secretary to the Cabinet. He was Chairman and Chief Executive Officer of the Manitoba Energy Authority and Chairman of the Board of Directors of Manitoba Hydro. In addition, Mr. Eliesen is a Partner and Director in the management consulting firm of Peat Marwick Stevenson & Kellogg.

As of November 1, 1992, Mr. Eliesen will assume the duties of Chief Executive Officer of B.C. Hydro.

Panel Discussion

Energy Development in Canada: Where Do We Go From Here?

Moderator: Marc Eliesen

Panellists
The Honourable James Downey
The Honourable Anne Edwards
The Honourable John Penner

Thank you, John. Good afternoon, ladies and gentlemen. As you know from our program, this is 'La Grande Spectaculaire,' this is the hit of this Forum, the Main Event that you've all been waiting for, where we present three live Provincial Energy Ministers, who will be discussing the future of energy development in Canada under the topic "Where do we go from here?"

1. Introduction

I would like to make a few introductory remarks before I introduce the Energy Ministers. Not long ago the question "Where do we go from here?" was a challenge that only interested engineers, economists and a few other professionals and technicians. The criteria were simple. Is it technologically feasible? Does it make economic sense? Once that was settled, the rest was fairly easy. You drew up some specifications, got some financial approvals and before long, the river was dammed, the oil well was producing, the mine was operating or the generating station was going full tilt. And the pipelines and railway rights-of-way and the transmission corridors were rolled out across the countryside in order to link these energy projects with their users.

2. The Complexity of Today's Energy Decisions

Well, maybe it was never that easy or that simple, but you and I know quite well that to get such things done today is infinitely more difficult and whether it's a coal mine or a uranium mine; whether it's an hydroelectric dam site, a refinery, or a nuclear plant; a pipeline, a railway line or a transmission line; all these are going to have an impact on somebody's backyard.

In the 1960s, Marshall McLuhan expressed the view that electronic communication had made a village of the entire globe. By the same token, when somebody today says, "Not in my backyard," they might be talking about the patch of lawn behind the house, or about the backwoods of northern Ontario, or they might mean the Brazilian rainforests, or for all I know, they might mean the Sea of Tranquillity on the Moon. The point is that nowadays the environment is everybody's business.

We, in the energy business, and a lot of other businesses, can't make a move without considering what that move will mean to the world and I do mean the world around us. The world of course includes the natural environment, from the beds of streams and lakes right up to the ozone level, or to the hole in the ozone layer. The world includes people and often because of the nature of our industry's resource needs in remote areas, this means aboriginal communities. Increasingly people are saying to us, "We don't trust you assurances that you are going to take it easy on the environment. We don't want your solemn undertakings that human needs will part of your planning process. We want to be part of the planning process right from square one."

3. Environmental Review Costs

It doesn't matter whether this is right or wrong. I believe it is a fact of modern business and it is a fact of life that's adding significantly to the cost of doing business. Let me give you a small example. At Ontario Hydro we have our 25-year Demand Supply Plan before the Environmental Assessment Board for a long hearing. By the time the hearing is over, we estimate it will have cost us roughly a hundred million dollars, of which between 25 to 30 million dollars will be in direct payments to intervenors. Now, some have suggested, facetiously, that this is the first guaranteed annual income program for lawyers and consultants. But it is a business that is going to be there and our particular hearing is merely examining the merits of our long-range plans, not a specific construction project.

These and other increased costs of doing business have led most of us in the electricity business at least, to look at new ways of doing our work. We found one way to avoid some of the costly planning, the costly hearings, the costly borrowing, and the costly construction; one way to slow down the spiral is to slow down the rate of growth and demand

for our products. I am talking here about demand management and energy conservation which is now the number one priority at Ontario Hydro. I don't want to go on in this particular area and I'm sure you are looking forward to the views of our panellists so I think we'll get on with the job.

Our first panellist is from Manitoba. Jim Downey is the MLA representing the riding of Arthur-Virden, where he was first elected to Manitoba's legislature in 1977. Mr. Downey is Manitoba's Deputy Premier, Minister of Northern Affairs and Native Affairs, and was appointed that province's Minister of Energy and Mines and Minister responsible for Manitoba Hydro in January of this year. Obviously, he wears a lot of hats and he has a very easy time making decisions, particularly when one of his ministries talks to his other ministry.

During his career in provincial politics he's held a variety of cabinet positions, including Minister of Agriculture and Minister of Rural Development. He's a director of the Manitoba Stock Growers Association and has farmed in the Melita area of Manitoba for 20 years.

Would you please join me in welcoming the Honourable James Downey.

The Honourable James Downey

The Forum themes of efficiency, trade and the environment define a critical path, in terms of energy policy and economic development, in a manner consistent with the principles of sustainable development.

1. The Importance of Agriculture

This panel, 'Energy Development in Canada: Where do we go from here?' gives us an opportunity to talk about the practical steps along the path and I should stop right here and tell you, in connection with Marc's introduction, that I am proud to be a farmer and I have spoken to many farm audiences and now that I have the energy portfolio. I have to be honest and open with you Energy Forum people. I continually tell the farm community that the energy that they produce, in the form of food, is far more important than any other energy that's produced in the world. I still believe that, particularly after the meals that I've eaten here in Victoria and the wonderful hospitality I've had.

But it is true that food is the most important form of energy in this country or the world, and I think we have to strive to work together to maximize its production. I should tell you a brief story. I am reluctant to take a drink of water when I speak to an audience that is either related to agriculture or to energy, because once I took a drink of water after I had spoken for some quite time at a meeting. Well, I stopped to take this drink, and a farmer in the back of the room said, "My goodness, that's the first time I've ever seen a windmill run on water."

Yesterday, from Derek Davis, I learned a new way to tell time. So I feel right at home with an energy crowd and the portfolio that I have. Our government, as has past governments in Manitoba, sees energy as an important component of the economic development thrust of our province. This is especially true with hydroelectric power. We are using a renewable resource to generate growth and development.

2. Rural Electrification

Thinking back to the days of the electrification of rural Manitoba, I remember the impact that it had on my mother and my family, and how important it was to the lifestyle of rural Manitobans back in the late 40s and early 50s. Maybe I am dating myself, but I am just pointing out how important rural electrification really was, and what it meant to our community.

I can also remember when some 20 per cent of North America's oats went to produce horse power and horses. We've changed from those days, and I don't know many people who would like to go back to those times either, particularly those who had the laborious task of looking after those horses.

Electrification was an important step in the history of Manitoba, and it has helped the overall well-being of all Manitobans immeasurably. Manitoba has the good fortune to be resource-rich, especially in terms of abundant rivers suitable for renewable hydro power development. As well, we have a small oil-producing area in southwestern Manitoba, the area which I have the privilege of representing. As Ed Schreyer said this morning, it may be a small oil patch in the Canadian context, something like one per cent of the total production, but it's pretty important to that constituency and to the people in the province of Manitoba affected by it.

3. Energy in Manitoba

We export some electricity and all of our crude oil production. On the other hand, nearly three-quarters of our energy demand is met by imported refined petroleum products and natural gas. Energy, the environment and the economy are inextricably linked. We are committed to implementing the principles of sustainable development in all aspects of the energy equation and are extremely pleased to have the international headquarters of the sustainable development unit in Winnipeg. I want you to know that we're all very proud of that.

Manitoba has no air pollution problems, which is in part a reflection of our good fortune to have abundant hydroelectric power. We are not a major contributor to greenhouse gas emissions but we want to be part of the solution. To that end, we have undertaken a comprehensive study of our greenhouse gas emissions. The resulting inventory will allow us to take constructive steps to ensure that we do not have a problem in the future.

Now, let's take a look at energy development in Manitoba. First, a bit of history. When Manitoba embarked on the development of the Nelson River, we recognized the long-term development of this huge resource required a strong integration of the Manitoba system with our neighbouring provinces and the United States. Our domestic load capacity has grown to 3500 megawatts and the interconnection capability is about 2000 megawatts. This makes Manitoba Hydro, given its size, one of the most heavily interconnected utilities in Canada. The interconnection provides significant benefits to Manitoba. Our rates are among the lowest in North America. Our system is highly reliable, with integration allowing for mutual support in the event of an emergency.

With the production capability and continuing demand, and the demand from our neighbouring provinces, we believe that some public policy to further develop this resource and to continue to strengthen our interconnections with our provincial neighbours, would not only be good public policy, but good Canadian unity policy, something that this country desperately needs.

If any of you question whether or not we actually do have the lowest rates in North America, those aren't my figures, they were in *The Globe and Mail* several weeks ago; Marc can confirm this, that we are truly quoted in *The Globe and Mail* as having the lowest electrical rates compared to Vancouver, Montreal, Toronto, Chicago, Detroit, Boston and New York. We just received a rate increase this year of some 2.65 per cent, and are projecting increases at the rate of inflation over the next two years and then a one per cent per annum increase from 1995 to the year 2002. And that is starting from the cheapest rate of any major city in Canada.

4. Future Energy Developments

I believe Manitoba should continue to plan for the future as part of the western region. Our next generating station, known as the Conawapa project, is the next major hydroelectric development on the Nelson River and, for the first time in the history of hydro development in Manitoba, the project will be reviewed by a joint Federal-Provincial environmental review process. We believe the generating station and associated transmission lines carry with them minimal environmental impacts. The natural high banks of the Nelson River at the location mean that the water will be primarily contained within the river banks. New flooding at Conawapa will be confined to an area of approximately four square kilometres.

The six-billion dollar Conawapa project will generate 1390 megawatts of power and will be the largest generating station in Manitoba's system. Development plans for Conawapa were based on the forecast need for a new source and an opportunity to sell power to Ontario, whose forecasts also indicated a need for a new source of electricity. The 13 billion dollar contract, for the sale of 1000 average megawatts of electricity to Ontario Hydro for 22 years, starting in 2000, was fully reviewed by the Manitoba Public Utility Board to satisfy the government and the public of Manitoba that the project was a sound financial investment. The numbers have proven that to be the case and, as I think Marc will agree, it is also a good deal for Ontario.

This project again demonstrates how important it is for our country's future that we work together and show practical applications of the benefits that we can share. Power from Conawapa will be transmitted from the north to southern markets by a new bipole 3 which will be the third high-voltage DC transmission line built by Manitoba Hydro. I'm proud to say that Manitoba Hydro pioneered this technology and it is being adopted by many other utilities. Bipole 3 again will undergo an environmental review process and will take a new path, closer to Ontario than the previous two lines, but equally important, it will provide increased security of supply in case of difficulty with the first two lines. We believe this is an important consideration.

The Limestone generating station, with a capacity of 1,330 megawatts, is the most recently completed project in Manitoba. Production began on September 8, 1990; it will be fully operational later this year. With the addition of Limestone, the total installed capacity of the integrated system will be 5,200 megawatts. Limestone's power will be used domestically as well as being sold to the Northern States Power Company in North Dakota.

Manitoba is embarking on a comprehensive review of it's own generation and transmission efficiency. Purchases from non-utility generation are also under active consideration. We are encouraging increased investment and exploration in Manitoba's 'oil patch' as well. Our current five-year drilling incentive program runs to the end of 1996. It covers all wells drilled and provides special incentives for horizontal and deep wells. In addition, the Manitoba Mineral Exploration Incentive Program began this April and provides the petroleum and mineral sectors with improved investment opportunities in resource exploration, along with enhanced funding for some junior exploration companies. As a part of our commitment to regulatory reform, we plan to introduce a new oil and gas act during the current legislative session which will consolidate a number of existing oil and gas statutes and incorporate the principles of sustainable development.

5. Native People

Times and approaches are changing. Gone are the days when economic benefits were the sole determining factor in deciding whether or not to proceed with development projects, and I want to just add some additional comments as the Minister responsible for Northern and Native Affairs. Over the last four years, I have had the privilege of working with our Native community. I endorse the comments Bill Wilson made this morning. I think he gave a strong message there for all of us.

You will recall Mr. Wilson telling us of a native community living for years almost underneath a high-voltage transmission line in British Columbia, and who were just now receiving electric power in their homes. Well, we have some 9 communities in northeastern Manitoba that live within a hundred miles of the Kelsey Generating Station, and they have to depend on a 15 amp electricity service generated locally from diesel fuel. But we have changed or are beginning to change that. Working with those Native communities, we have recently signed a 117 million dollar agreement with Hydro, the Federal government and the Province to start the process of bringing an overland line to those communities to take them out of 3rd World conditions.

I say very sincerely that the native people want to be part of these developments. They don't want to be excluded; they want to be included. We are, as well, showing progress on negotiation on our northern flood agreement that was signed between the governments, Hydro and five northern Indian Bands some 15 years ago, but which has made very little progress since then. I can again report today that the Split Lake Cree will be going to their people on the 1st of June to vote on whether or not they are prepared to accept a final offer, including land, a monetary settlement and co-management of their resource area.

I think this is a very progressive move which has been driven mainly by the band Chief, who sees it as being in the best interest of their communities. Of course, we, the government of Manitoba, will be working closely with them to try and accomplish that goal. I believe it is essential that we weigh carefully, the impact of development on our environment and people. Tied to that is the change and focus to encourage increased energy efficiency and conservation which has been talked about very strongly at this conference.

6. Utility Employees

I want to comment about the employees of Manitoba Hydro. I think they are dedicated people, as are the people in other utilities throughout this country, dedicated to making sure that we have the continued resource that we all rely on so heavily. We, like all the major electric utilities in western Canada, are members of Power Smart, which, of course, promotes improved energy efficiency and conservation.

The same principle applies to natural gas and refined petroleum products. Our government is encouraging the natural gas utility to undertake demand-side management initiatives. Here, we have also made a net gain. Load-levelling and increased efficiency have improved the load factor, resulting in lower costs to the consumer, and at the same time, minimizing the environmental costs.

Manitoba does not have a marketable supply of natural gas; however, there continues to be increased demand for certain industries and for alternative heating fuels in Manitoba. We have currently initiated discussions with Saskatchewan as to how we could use their gas as an alternative energy source, particularly in our border communities that are currently not served by pipeline gas, as are the traditional highly populated areas. Again, using more Saskatchewan or Alberta gas in Manitoba may encourage a greater use of our hydro power in Saskatchewan.

7. Conclusion

I will conclude with an answer to the question posed in the title of this panel, "Where do we go from here?" We accept the challenge. As a government, we truly accept the challenge and ideas that come from everyone are important. We will continue our efforts to be more efficient energy producers and consumers. We will carefully consider all options and their potential benefits and impacts. In short, we will make sustainable development a reality in our decision-making process.

The essence of Canadian trade is co-operation. That is why it is so important to keep this country united. We cannot allow this country to separate for the sake of our future or our children's future. We must maintain this country as we know it today and improve it where we can, it's a country that I am very proud of. Thank you, Mr. Chairman.

Marc Eliesen: I won't repeat all of Anne Edwards' background, as she was our lunch-eon speaker today, but I'll just mention that she was first elected to the B.C. Legislature in 1986 and was appointed Minister of Energy, Mines, and Petroleum Resources in November of 1991. Please welcome again, the Honourable Anne Edwards.

The Honourable Anne Edwards

Thank you, Marc. Good afternoon, ladies and gentlemen.

I noted at the luncheon today that British Columbia is in a very fortunate position. We have many energy resources. We have many energy ideas. We have many

interested people and we have many, many options from which to choose. That, of course, presents its own problems but we are very happy to have them.

1. Optimal Development Policy Objectives

Our challenge, of course, is to develop the options in a manner that maximizes the benefits to the people of the province. And I define those benefits very broadly. They include social benefits, environmental benefits, and economic benefits, and they also have a time dimension to them. They must be benefits that are benefits today, but even more importantly, they must extend into the future and they must give us an extension into the future that is valuable for us and for our children.

The objectives that we may see right now may appear to be in conflict with each other. For example, and the most obvious one, of course, is jobs versus the environment. That is almost taken to be a 'given' these days. Too many people take it as an 'either-or' decision. That is an oversimplification. We should look at it from a societal point of view, the environment and the economy, the benefits from these things, and usually the social benefits in general are quite consistent. So it is consistent to consider them together. If we look at it from the broad perspective, we will be able to see the consistency and we will be able to do our planning better.

2. Sustainability

The concept of sustainability is not new, but we are still having problems implementing it. We run into trouble, for example, when the costs and benefits are not shared equally by conflicting or opposing interests. In sorting out the parameters of how we do this with which methodologies, we are going to have to take some time and we will have to recognize that we are all perhaps going to share in the costs as well as the benefits. What is certain, though, is that if the social costs are included. We, and I include here individuals, businesses, institutions, and industries, we will generally have to pay more to maintain our present consumption patterns.

Where do we go from here? As I say, we have many resources in British Columbia, and I am sure that many of these supply-side options will be developed to meet growing demands. But we are going to want, as we develop these resources, to have a full accounting of all the costs that are involved. That is not easy, because the more dimensions that you bring in, the more difficult it is to cost them on an identical basis. We will do a lot of integrating of the apples, oranges and bananas to be sure that we have a fruit salad that suits us. We really have not done a lot of that yet. We are experimenting with it. We are looking at full-cost accounting and we are co-operating with other provinces and the federal government in reaching a goal that will be very effective for us.

I believe we all agree that the major issue for us is conservation and efficiency. I use the words separately because conservation doesn't necessarily mean efficiency, but perhaps it should. What we want is a strong thrust in the direction of conservation and efficiency. I believe very firmly that we must in future find ways to involve the public in the decisions in which they demand a say. One of the key responses to that is the creation of the B.C. Energy Council. The council was recommended independently by the Round Table in their recent report. The B.C. Environmental Network's recent paper reached conclusions that pointed in the very same direction.

I am sure the Council will receive good support and co-operation and will be effective in what it does. As I said, it was going to be difficult to talk about conservation in British Columbia unless we made it part of the efficiency argument, because in real terms, we have lots of resources. With lots of resources, the reason to conserve just for conservation's sake is not broadly supported by the public. It's not always seen to be something you need to do, when the resources are just sitting there.

3. Efficiency

So we have to look at efficiency, and I believe that most people recognize that value; it is not just an economic value, it is an ethical value as well. I believe that is the direction in which we should go. We are going to have to garner the maximum benefits from the resources, and minimize the environmental impacts. As I said at lunch, I think the impact of the B.C. Energy Council will be significant.

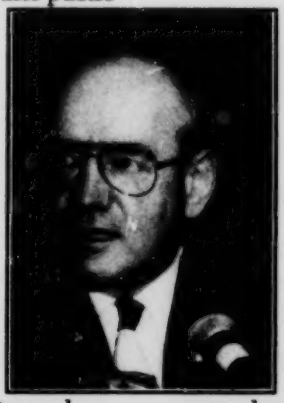
We all know that energy has a huge impact on our daily lives, on the economy and the environment. I want to talk more about public involvement through an analogy. If you are walking alone and you make a movement, it doesn't affect anybody else. But when we all link arms and are walking side by side, every time somebody makes a movement, it affects everybody else along the line. I think that we are beginning to see that kind of thing happen in our world, and that has given the thrust to the desire for involvement and perhaps the willingness to be involved with other people and to share opinion-making and decision-making. British Colum-bians want to know what the choices are and what is available; they want to know what the trade-offs are and they want to exchange those views amongst themselves. That is a very necessary part in developing our long-term goals and our plans.

Conservation is not new and perhaps the general acceptance of it is indicative of the fact that it has been around for a while and had very strong proponents for it. As Amory Lovins said, 'Conservation is not only a free lunch, it's a lunch you get paid to eat.' Now it is the logical choice because it saves money, is an efficiency measure and it helps us not only locally within our regions but it helps us in our world relationships, our export trade, our global relationships with countries. It slows the energy demand and, in general terms, can save us money, that is, save us tax dollars. It defers the need

for whatever the more costly options are, if we are costing things correctly. Then we know that we are getting the least-cost energy supply. Conservation is an all-around good thing.

4. Conclusion

I am going to close with some of the other public process initiatives that we are taking in this province. The B.C. Energy Council is only one of the things that we are doing, but energy is not a stand-alone issue. It is connected to many of the land-use issues and therefore is just one of a number of public processes that we are looking at. Some of the key ones are going to make a difference to what happens in our energy world in the future. One of these initiatives is the Commission on Resources and the Environment which was recently established in British Columbia. The Commission, under Steven Owen, is expected to come up with some processes for regional involvement in land-use decisions. When the regions are ready to work on land-use decisions as a group, and to look at where they are and where they want to go, they will in the future be working under the Commission's umbrella . We should then be able to make better land-use decisions. And energy decisions are involved in this process.



Another initiative that's will make a big difference in British Columbia, is that we have launched negotiations with Aboriginal peoples to settle the Aboriginal Land Claims issues. Those issues involve our resources, including energy, and certainly the Aboriginal people have said very clearly to us that they are interested in developing energy resources and that they are also interested in the land-use questions.

There are a number of other issues, but I believe that they always come back to this: how to involve the public in conservation and efficiency. That is the direction in which we are going and I suggested some of the things that we will have to do and the processes that we will need in order to keep us on the right track .

Thank you.

Marc Eliesen: Thank you, Anne. Our last panellist this afternoon, the Honourable John Penner, is the Minister of Energy and Mines in the province of Saskatchewan. He was educated at the University of Saskatchewan. Mr. Penner was first elected to the Saskatchewan legislature in 1991, representing the riding of Swift Current, and was appointed the Minister of Energy and Mines, and is responsible for the Saskatchewan Research Council, the Energy Conservation and Development Institute and the Wakarnow Valley Authority.

Prior to entering politics at the provincial level, he served at the municipal level as a civic councillor in Swift Current. Mr. Penner is an educator by profession and has served as president of the Western Credit Union for 12 years.

Please join with me in welcoming the Honourable John Penner.

The Honourable John Penner

It is a pleasure for me to be in Victoria today at this conference for several reasons. When we left home yesterday, we stopped in Calgary in a snowstorm. I phoned back to Regina this morning and found it was snowing in Regina too. I understand that Jim Downey will have snow tonight in Virden. So that's one good reason for me to be here; your spring weather is so much better.

The other reason I am pleased to be here is that on Thursday, the Saskatchewan government brought down its budget and it is always a good thing after the budget comes down to have no phone number and no fixed abode, for at least a short period of time.

So I'm happy to be here on those two accounts. I'm also happy to be attending this conference. I think it is a very important conference to participate in and I am pleased to bring you a few remarks about what's happening in Saskatchewan, and where we think and hope we are going. We are working very hard to get there.

1. Saskatchewan's Energy Resources

Saskatchewan is fortunate to be well-endowed with energy resources. We are a net exporter of primary energy resources including coal, natural gas, crude oil and uranium. We are self-sufficient in electricity production and produce about half of our demand for refined petroleum products. We have a mature energy industry working within a well-established regulatory and fiscal framework. At face value, when I say this, it sounds like that is a sure recipe for success and I just wish that my job were just that easy, but it isn't.

On the other side of the coin, the energy industries in Saskatchewan and Canada are facing some unprecedented challenges. The first is that our oil and natural gas producers are facing some of the lowest real prices for their commodities in decades. As the western sedimentary basin matures, reserve additions through new discoveries are diminishing very quickly and environmental realities are putting new pressures on both the upstream and downstream ends of the energy sector. Resolving these challenges is crucial to future energy development in our part of Canada.

2. Government and Industry Partnerships

Governments and industry must form a strong partnership to ensure industry's competitiveness both economically and environmentally. Facing these cir-

cumstances, both groups need to work together. We need to improve the cost-control measures to reduce the high costs of producing primary energy resources. We need to implement new technologies to improve recovery and to reduce costs. As the difficulty of finding new resources increases, we must recover more of what we have already found and reducing the environmental impacts of producing and consuming energy is an absolute imperative.

Let me briefly cite some recent examples of Saskatchewan's successful initiatives in this regard. Since the first horizontal oil well was drilled in Saskatchewan in 1987, horizontal wells have allowed the oil industry in Saskatchewan to do three things. They've reduced the unit cost of production, they've increased the percentage that can be recovered and they've substantially reduced the environmental impact through surface land disruptions. In December of 1991, 218 horizontal wells produced about 12 per cent of Saskatchewan's oil. This percentage is increasing monthly as new horizontal wells come on stream. Horizontal wells have been developed in Saskatchewan through a strong industry-government partnership. The technical risk of drilling the first few horizontal wells was cost-shared by the government. Once the technical potential had been demonstrated, government and industry worked together to establish a fiscal framework that would encourage widespread application of horizontal wells to the mutual benefit of both the industry and our government.

Talking about the horizontal wells, another exciting technology development is the potential of increased production through CO_2 injection. This technique is currently undergoing some testing by Shell Canada in the Mydale area, near Estevan. CO_2 injection can substantially increase oil recovery with the added benefit of preventing this greenhouse gas from entering the atmosphere. Once again, through a strong industry-government partnership, we see a bright future for this technology in Saskatchewan.

3. Fossil Fuel Resources

Natural gas is also an important energy commodity in our province. This clean and economic fuel is currently suffering from low prices. In Canada, the traditional gas market is maturing, but an exciting new area is the growing use of co-generation. Co-generation offers the opportunity to use natural gas in a more efficient manner. This increased efficiency results in a much-reduced environment impact from fossil fuel use.

Coal has long been an important energy commodity in our province. To ensure coal's continued use, we must look for ways to improve the efficiency with which we use it and reduce its impact on the environment. To this end, Saskatchewan is very interested in the Integrated Gasification Combined Cycle (IGCC) for power generation, both as an improved generation technology and as a stepping stone to still more advanced technology such as fuel cells. A further benefit is the potentially economic capture of the CO_2 from an IGCC plant when we have a ready-made market for in Saskatchewan for enhanced oil recovery using CO_2. Currently, the people who are using CO_2 injection for enhanced oil recovery are transporting their gas from Medicine Hat or the United States. With an IGCC plant at a power station in Saskatchewan, we could provide most of the CO_2 necessary for the enhanced oil recovery in the Mydale field.

4. Environmental Competitiveness

A recurring theme with all these examples is that, in many instances, improving the economic competitiveness of our producing energy industries also results in improved environmental competitiveness. We must strive to use our energy more efficiently with a smaller impact on the environment, while still ensuring continued economic development. This is going to require some very fine balancing on the part of economic development and environmental sustainability.

We are encouraging the use of alternate energy sources, particularly energy from wind, solar power, and ethanol from agricultural products. Just this year, our Premier announced that Saskatchewan Power will purchase power from independent producers who may generate this electricity from wind power, solar power, or co-generation. They will purchase up to 100 megawatts before the end of this year if the producers can provide the power. These renewable forms of energy represent an important opportunity to promote clean energy sources and to prolong the life of the non-renewable resources that we currently have.

5. Energy Conservation

We are examining the roles and responsibilities of government in encouraging energy conservation. Meeting these challenges in Saskatchewan, as well as in Canada, is no simple task. To meet the challenges, we are undertaking the development of a comprehensive strategy that will map out future energy development in Saskatchewan. This development plan covering energy conservation and efficiency as well as energy production, will be conducted in full co-operation and consultation with the stakeholders. To assist us in this partnership with the stakeholders, the government is creating the Saskatchewan Energy Conservation and Development Institute. This Institute will advise government on a broad range of energy issues and expedite the implementation of technologies to help the province meet its environmental and economic challenges. These actions, among others, will lay the groundwork for future energy development in Saskatchewan.

We in Saskatchewan look forward to working in co-operation with our neighbouring provinces and the rest of Canada to achieve energy development in an economic and environmentally safe manner.

Thank you very much.

Marc Eliesen: Thank you, John. Well, ladies and gentlemen, we now come to that part of the program which can be entitled, 'It's Time to Embarrass the Ministers.' They've had it relatively easy so far. They've had an opportunity to respond to the main subject matter as to 'Where do we go from here?' and you've heard their general remarks and orientation.

So let me start off by giving an easy question to my friend from Manitoba. The question is: "Are there outstanding Aboriginal land claims on the areas covered by the Conawapa project or the new transmission line?" The second part of the question, which also deals with some of the other questions on the subject matters that have been raised, is: "What public review process is taking place other than the joint senior level government assessment?"

James Downey: The answer to the first question is 'no,' there are no outstanding claims involved.

On the second question, dealing with the environment, there are two other environmental reviews. There is a joint federal-provincial panel dealing with the structural side of the dam project and, as well, there will be an environmental review of the Bipole 3 proposed route. And I should have indicated earlier that on the proposed land line to the nine communities that haven't enjoyed hydroelectric power, there is also an environmental review process taking place, and two of the three panellists are Aboriginal.

Donald Scarlett: My name is Donald Scarlett, I am with the Kootenay-Okanagan Electric Consumers Association, which is a ratepayers organization located in the south-central part of the province. As a ratepayers advocate, I am particularly interested in public processes and I would like to address this question, if I could, to the guest speakers from Manitoba and Saskatchewan and actually the moderator from Ontario as well. My question is, 'In your respective provinces, do you have a public involvement process involving provincial policy, energy policy that would in any way be comparable to what we've now begun in British Columbia with the B.C. Energy Council?'

John Penner: We don't have something exactly the same as B.C. in Saskatchewan, but we do have a public involvement process. We just finished a Round Table on the Environment and on a Clean Air Strategy. The Institute I mentioned in my talk is in the process of being formed. This institute will consult with the stakeholders in the province to determine what sources of energy we will develop, how we will develop them and at what cost. The Institute will also advise the government on which of these energy sources are probably the best ones that we should be using. So we are getting involved in a public process. It's not exactly the same as B.C.'s, but it's a similar process and when we develop our comprehensive energy strategy, there will be public consultation, where we will go around the province and meet with stakeholder groups. We are not planning to put any money into the stakeholder presentations because we feel that we can get around to most of the province without giving them a lot of funds.

James Downey: To the question dealing with any rate increases or costs to the consumer, all activities have to go before the Public Utility Board in the Province of Manitoba. The issues dealing with the environment, of course, have to go before an environmental panel. But as to whether we have a structure similar to the proposed B.C. Energy Council, no, we don't.

Marc Eliesen: Just very quickly with regards to Ontario, Ontario probably has the most comprehensive environmental assessment act, which requires utilities such as Ontario Hydro to come before it both on the question of need and the question of site-specific applications, so there is quite an active and involved process that has been in place in Ontario for quite a number of years now. I mentioned to this in my opening remarks.

Here's a question for Anne Edwards: 'Millions of tons of wood residues are burned in British Columbia. What priority will the Minister give to the creation of wood-burning power plants, considering that such plants are consistent with sustainability objectives?'

Anne Edwards: We already have one wood waste plant being built at Williams Lake, as British Columbians may know; and there are a number of projects waiting, and some of them are even knocking at our doors asking us to hurry up. There are two things that are keeping the pace quite moderate. One is the demand for electricity in British Columbia, which is not growing as rapidly as expected, so for the domestic supply there isn't an immediate need. For export, as I said, we are examining the issue of exporting electricity. So while we are not proceeding fast to use all that wood waste, some of which is already being burnt to produce power, we expect to deal with the issue within our planning. It is one of those things that has a priority. It's a co-generation situation. It's often a replacement situation and I agree that wood waste plants seems to be a very good idea. So they're sitting right at the front of the queue.

Phil Larstone: I'm Phil Larstone, of the B.C. Energy Coalition, from Prince George. I'm glad to hear that Saskatchewan is pursing wind energy and I rather regret that Alberta isn't represented here, because I'd like to hear about the Southern Alberta Renewable Energy Institute, their pilot projects and their progressive purchase rates for IPP wind electricity producers. I hear from the Pacific Northwest that wind energy is now costing about 5 cents a kilowatt without any externalities costed. So my question is: 'Are any of the other provinces pursuing this resource, doing any wind mapping or encouraging private projects? Is there anything in the wind for pricing policies to give it an incentive?'

James Downey: Very limited work has been done in Manitoba so far, but it's an area in which I think there are some potential activities that could be developed.

Anne Edwards: I would just like to say that it's an acceptable alternate energy source and we are going to be looking at ways to move in that direction.

Marc Eliesen: Thank you, panellists. I have a question which has been posed to all the panellists. It is as follows: 'What are the prospects for improved energy collaboration among the western provinces in technology, in assessment methodology or any other areas?'

John Penner: I would like to say that energy collaboration is one of the things that I had sort of written in the margin of my notes. I think it is an important factor for in the duties of all energy ministers in this country today. One of the things that occurred to me, when we were preparing for this conference, is that every province seems to have a power corporation or hydro, or whatever you want to call it, in whichever province you are living, that has a vested interest in generating electricity even though they might be able to import it at a lower cost.

What has struck us in Saskatchewan is that for us to generate electricity, which we can do fairly cheaply using coal, is that there are all kinds of problems involved in using coal to generate electricity. It would be a very simple thing, as Jim Downey pointed earlier, for us to do a little trading of energy or power sources. We have an abundance of natural gas, of which we are currently exporting a lot to Ontario and it flows right through Manitoba, and Manitoba has an abundance of electricity. We haven't reached any kind of agreement in trading these energy sources but I think that it would be valuable for us to sit down and discuss the possibility of doing just that, without each of us putting a lot of money into capital projects and generating our own. In the case of Manitoba, they don't have the gas and we would be very happy to supply them with the natural gas. So I think we are very interested in doing something of this kind.

Anne Edwards: We have an integrated grid system between British Columbia, Alberta, and the northwestern states and that, of course, is very beneficial to efficiency on the grids. British Columbia has also established Power Smart, and B.C. Hydro will tell you, very correctly, that it is a good program which they have marketed to other energy utilities in western Canada. I know they've worked with Ontario as well. As I said before, there is an initiative to develop some total costing methods, which would involve all the provinces. Finally, I would like to say that we have worked in conjunction with both Alberta and Saskatchewan to try and sell some coal to Ontario, the province that uses coal to generate electricity and imports it from the U.S. So we are all looking at ways to increase exchanges.

James Downey: Right on. It's the price.

Marc Eliesen: There's always some barrier.

James Downey: Briefly, I was part of a government from 1977 to 1981 that embarked upon what was called the Western Power Grid. There was some agreement in principle established between Saskatchewan, Alberta and Manitoba. I believe that western Canadians, all Canadians, want politicians to put their petty politics aside and do what's in the best interests of this country. Where it makes common sense, we should work together to do that, whether it's gas, hydro, or any other energy source. If we can remember our history, it was the railroads that first bound this country together as a Dominion, and I think there are a lot of similar ways which we can demonstrate our ability to work together. We now have the proposed transmission linkage with Ontario. I can see us developing that further with Saskatchewan and probably Alberta someday as well. But I think it takes, first of all, the political will to do it.

Eliza Olson: I am Eliza Olson, president of the Burns Bog Conservation Society, an organization that's been active for the last four years. I'd like to give you a little background on why I'm here and why I'm asking these questions. Since getting involved in trying to save this unique area, which is the largest peat bog on the west coast of the Americas, I've come to appreciate the importance of peat bogs.

We have been focusing on forests and the importance of preserving forests to stop global warming but sometimes we can't see some of the trees for the woods. David Scott got me thinking the other day when he was talking about light bulbs and what happens when you turn them off in Ontario, and sometimes the obvious isn't so obvious. As an example, there's a story about a truck stuck in the Deas Island tunnel, and everybody was looking at the top of the truck and wondering how they could lower the top so they could get it out of the tunnel. Finally somebody said, 'Why don't you let the air out of the tires?' That solved the problem.

Welooking at trees because they are obvious. Peat bogs hold 40 per cent of the world's carbon. Ironically, you'll find information about peat under mining. We talk about peat mining even though we are talking about a living organism. Peat bogs are created by a little plant. All but two per cent of the peat in the UK has disappeared. Scientists now think that one of things that we must look at is peat bogs and start protecting them because when you destroy peat bogs, you release carbon and methane which affects global warming. What are the various provinces doing to protect peat bogs?

James Downey: I have to admit that I have very limited knowledge about the subject which you've raised. I presume that we would have a licensing process in place that regulates the amount of product that can be

taken from a bog, but I know we do have an Act controlling peat processing in Manitoba.

Eliza Olson: Your friends have told me what's happening in Manitoba. They burn the peat bogs. In Ontario, I know you are trying to save the Alfred Bog. I don't know if you have been successful yet or not.

James Downey: There are restrictions on burning in Manitoba as it relates to the peat bogs.

John Penner: Well, I really have no comment to make. I am very interested in what you are saying. Saskatchewan, as you know, is not the most forested region in the country so ...

Eliza Olson: I was born in Meadow Lake and my father homesteaded around Swift Current.

John Penner: Practically everybody I meet is from Saskatchewan. Everybody west of Saskatchewan came from Saskatchewan. So it's great to be home.

Marc Eliesen: A question for Jim Downey from Manitoba. This relates really to his reference to *The Globe and Mail* article reporting that Manitoba has the lowest electricity rates in the country: 'How can you brag about low power rates when we all want to encourage conservation?' And related question has been asked: 'Shouldn't price increases be utilized as a method to encourage conservation?'

James Downey: I disagree with the idea that consumers shouldn't be able to benefit from a resource that is there and able to be provided at a certain cost. I believe what we are trying encourage are energy users who are looking for an alternative to, say, burning coal, who could use hydroelectric power, so that we would encourage them to come to Manitoba to use it.

Marc Eliesen: To John Penner: 'Will you direct Saskatchewan Power to purchase co-generation electricity from private power producers?'

John Penner: I mentioned in my talk that the Premier announced that within the year we will be buying a hundred megawatts of power from private independent producers. We are not specifying what energy source they have to use to produce this power, but we currently have several wind-farms on the drawing boards. People are interested in generating electricity using wind and we are certainly talking to people who want to use co-generation. But we want to make sure that the co-generation project that they are going to use makes a lot of sense so that we don't only get electricity and one industry off the grid, but we would like to get two or three industrial spin-offs from the co-generation plant. So we will be buying some power from independent producers.

Marc Eliesen: To Anne Edwards, a number of questions which I will try to combine, which refer to the roles of some old and new players in the energy field in British Columbia, such as the newly created B.C. Energy Council, B.C. Hydro, and the regulatory agency, the B.C. Utility Commission. The questions in general are: 'Don't the roles of these organizations overlap? And, related to that: 'Where should the priority of energy conservation rest? Should it be with B.C. Hydro? Should there be direction from the regulatory agency or from the B.C. Energy Council?'

Anne Edwards: First of all, what we see in the B.C. Energy Council is another step. We want the Energy Council and what it does to be in addition to what is already going on in the province. For example, B.C. Hydro has done a lot of planning, and it does excellent planning. We want that to be part of what goes into the Energy Council, but of course, the Energy Council deals with all forms of energy. We hope that it will have input as well from the other utilities including B.C. Gas and other non-electrical utilities. So with B.C. Hydro and the other utilities, we hope they'll be part of the input. We hope that basically there will be good co-operation amongst the existing entities. It's not a zero-sum game.

We hope it is an addition to bring the B.C. Energy Council on board and to have the function that it is going to carry out – we recognize it as something that hasn't been done before – and we want that to be an additional thing to be valued by everybody. It will not only serve everyone's interest, but we hope they will participate, too. So very clearly, it is something that is an add-on and we want it to work that way.

Energy conservation, I believe, is a well-accepted direction that we are going to pursue in British Columbia, and I think that the government says that we are interested in going in the way of conservation. We got elected on the platform. I believe that the people of British Columbia want to move toward energy conservation and I think that we'll make it work.

Lenore Herb: This question is also for Anne Edwards. It is in regard to a copy of a letter that I have from the Honourable Moe Sihota to the B.C. Utilities Commission. It's on public record, and it indicates that the Cabinet Committee on Crown Corporations has already decided to allow B.C. Hydro to export power from Burrard Thermal, even taking air emission concerns into account. This seems to me to be direct political interference into a public process. And what I am wondering now, considering the remarks you made at lunch regarding your support of the public participation process, what will be the relationship between the Cabinet Committee on Crown Corporations and he Energy Council and the public participation process? How will that affect meaningful public participation in the time to come?

Anne Edwards: Let me go back a bit. Those were a lot of organizations that you talked about. The ones that we are dealing with right now are the B.C. Utilities Commission, who are currently involved in a decision on the export of short-term and interruptible power which does not require any new generation facilities in British Columbia.

In dealing with that, they reviewed the role of B.C. Hydro's Burrard plant. The Minister responsible for B.C. Hydro wrote a letter to the Commission to state that it was clearly the position of the government that the Burrard thermal plant is important to B.C. Hydro. To follow up on that letter, one of the staff members of the Crown corporation appeared to put the position and to explain what the letter meant. So basically that is specific information that is appropriate for the Utilities Commission to hear. The Minister responsible for B.C. Hydro put forward a position for B.C. Hydro that he felt had not been heard before the Commission.

Doug Gook: My name is Douglas Gook, representing the Cariboo Horse Loggers Association up in Quesnel. My question is to all three of the panel members with regards to the new responsibility required for those provinces that are involved in the export of energy sources. The realities that we are facing in terms of global ecological conditions are going to require, I think, a new responsibility for those that are providing materials in export in relation to how those materials are used and the efficiency of their end-use for combustion. In regards to nuclear power, there would be other responsibilities required. I am wondering what your ministries or your governments are doing with regards to tying more responsibility for our exports to their end-use and their relationship to global ecological conditions.

James Downey: We believe that hydroelectric power is one of the cleanest forms of energy there is, but we have very little control over what happens to it after it leaves our province.

Anne Edwards: I assume, Doug, that you were talking partly about the export of gas for the generation of electricity south of the border.

Doug Gook: Yes. Obviously, nuclear fuels and coal and gas have all kinds of different uses at the consumer's end. But the fact is that we all get it in the end as greenhouse gases, with regards to global warming and those kinds of things; there needs to be potentially some greater responsibility taken when we do look at exports in terms of how they will affect us all in the end.

Anne Edwards: We are certainly aware of the problem. How we will put it in place we are not sure yet. But we are planning a close look at the issue of natural gas generation of electricity, because that effects us both coming and going; that is in progress now. With the export of coal, and I know the export curve is going to be up for thermal coal, I believe that our countries are responsible for assuring that if coal is what is going to be required to provide power for third-world countries, then we should also feel responsible and be responsible for assuring that there's technology to burn it efficiently.

John Penner: I'd like to just comment on two issues that you've raised. First, let me comment on coal. I mentioned in my initial remarks that Saskatchewan is very interested in the Integrated Gasification Combined Cycle, the IGCC, and this may be the best Forum that I could ever talk to that would give me some support on this. We need some support from not only other coal producers but generally from governments across Canada to help us with this initial technology: to develop it, to build a demonstration plant and if the demonstration plant proves successful, there will be several spin-offs from this. One of them would obviously be a cleaner environment, which is probably the most important one, and the other is that we could sell this technology around the world to other people who buy our coal.

And since the person in charge of Ontario Hydro is sitting here, I'd like to have his signature right now on a piece of paper saying that Ontario will co-operate with us in an IGCC plant so that when we sell the low-sulphur coal to Ontario at very competitive price, the only reason it is expensive is because the railways charge so much.

Anne Edwards: There are Manitoba's taxes, too.

John Penner: Well, someone is charging us; someone is ripping us off in between, I'm not sure who it is.

James Downey: We lowered the tax.

John Penner: But anyway, I would like to go on record that we would very much like to put this demonstration plant in place so that we could show to the world that there is a way in which you can use coal efficiently and in an environmentally safe way.

You hit another sort of important aspect of Saskatchewan exports and I've skirted it so far, and that's uranium. Let me say at the outset, that Saskatchewan does not produce any electricity using uranium. We sell the uranium all around the world, everywhere, and it's a concern to me personally and it's a concern to our province too, as to what happens to the spent fuel after it's been used to generate electricity. And we have no easy solution. Everybody says that we should store it in a safe manner but nobody wants it in their backyard, so it is a little difficult for me to answer that question. But it's a concern to us when we export it, it's a concern to us what happens to the spent fuel but, unfortunately, we are not doing anything about it at this stage.

Marc Eliesen: John, related to that subject matter, here's a question which asks: 'Where does the Province of Saskatchewan stand on continued use of nuclear

energy? Do you see a future for development of nuclear energy in the Province of Saskatchewan?'

John Penner: I suppose there's a future if you look far enough into the future, but there is no future for nuclear generation in Saskatchewan in the immediate future, for several reasons. We have a plentiful supply of electricity right now; the projects that Saskatchewan Power planned to build a few years ago have not yet been needed. We have plenty of electricity for our own consumption. We have a plant on the drawing boards now and we've already invested a considerable amount of money on a coal-fired plant where we want to put the IGCC unit. That's already in the planning stages and when that plant comes on stream, we probably have enough supply to last us to the year 2005, maybe 2010.

In the immediate future, I don't think there's any need for us to go into generating electricity using nuclear power. We are also not convinced that it's cost-effective at this point, even though the uranium is in our province, we mine it here and we could obviously sell it to a utility fairly cheaply if we wanted to, but we don't see that as being cost-effective right now to use nuclear energy.

Marc Eliesen: Let me summarize two or three questions addressed to Anne Edwards related to the Columbia River Basin. 'People have referred to past energy projects such as the Columbia River Treaty dams. Would the government of B.C. consider using some of the money from downstream benefits to undertake particular projects and to restore some sustainability to those communities which had been affected earlier?'

Anne Edwards: Since I represent some of the communities that were affected, it's an interesting question. We are currently putting together our strategy for dealing with the return of the Columbia River Treaty downstream benefits and we have talked to the communities in the region about their interests; we are well aware that a number of Kootenay communities experienced impacts for which they were not paid back. Some of the impacts were not even mitigated. One of the ironies of the Columbia River Treaty is that there are people in the west Kootenays who don't even get their power from B.C. Hydro, even though B.C. Hydro was the entity in those developments. Our government is talking with these communities and we are putting together some economic plans; I'm sure that the downstream benefits are going to be part of those discussions.

Sue Hiscocks: I'm Sue Hiscocks. I'm with the Sierra Club on Saltspring Island. The effect of ozone depletion on climate stability is going to affect all of the projects we are concerned about here. I would like to know what the provincial ministers are going to do about getting Ottawa to stop CFC production? Because the provinces are now saying that it's a federal issue to stop production of CFCs. They are not going to stop until 1995(*1997, actually. ed.*). There's ten million pounds a year going up and perhaps a 30 to 40 per cent depletion in the ozone layer predicted for the very short near future. Can you influence Ottawa in some way?

James Downey: I can take your message to the Minister of Environment in Manitoba, because that's whose jurisdiction that falls under.

Anne Edwards: Yes, we also work with our Ministry of the Environment on clean air strategy and are looking toward more work in the province and also participation with the Federal Government in this issue.

John Penner: I think I have much the same answer, but it falls to our Ministry of Environment and I don't have any further information on that at this point.

Jim Sloan: I'm Jim Sloan, representing the Western Canada Wilderness Committee. I live in Ladysmith, here on Vancouver Island. I just returned from a trip to Manitoba and northern Ontario, the gateway to the Arctic, Moosonee. I was astounded to be walking through cans, aluminium cans underfoot just about everywhere. It was brought to my attention that Ontario had backed out on legislation for charging deposits on aluminium drink containers. Given that aluminium is 95 per cent more efficient to produce through recycling, I would appreciate it if the moderator could possible address that issue. And as I came through Winnipeg, I would like to know what the province of Manitoba is doing in terms of recycling efforts. Finally, to the Minister from British Columbia, I am concerned about the Kemano project for that reason as well.

Marc Eliesen: Jim?

James Downey: I thought you were to answer.

Marc Eliesen: No, the moderator doesn't get involved in these things.

James Downey: We are embarked upon a Fun Day program to pay for recyclable containers and that type of product through our Department of the Environment.

Gwen Johannson: I'm Gwen Johannson, representing the Peace Valley Environmental Association. My question is addressed to the three ministers. Mr. Penner, I believe I heard you say that we must decrease the environmental impacts, while at the same time, we increase economic development. The theme of the panel is: 'Where do we go from here?' And the other phrase that comes to my mind is: 'You can't get there from here'. I am wondering if any of the three of you foresee a time when we will have to look at environmental costs and economic growth, and say that environmental costs are too great and we must put a curb on economic growth.

Marc Eliesen: Thank you. That's a good question. I think actually it is an excellent one to wrap up this

particular panel and to provide an opportunity for the Ministers to respond directly to the question as well as any other aspects to the general question of, 'Where do we go from here?' Maybe we can start with John Penner.

John Penner: Thank you. I think I did make that statement and I also have to say that I don't always write my own speeches. But regardless of that, I do believe that I would have made that statement anyway.

There has to be a balance but no one has the answer. At least, I haven't found anyone yet in the short period of time that I've been in government. No one knows where that balance is. We've got people on both sides of the spectrum, including people who want economic development and may want it at any cost, but there are very few of those left. Most people who want economic development want it done in a responsible manner. At least, the people I talk to tell me that and I believe that they do. They want to be responsible in their development.

But they are very concerned that some other group, which also has an agenda, the environmentalists – and I appreciate what the environmentalists are doing, I think they have a very important part to play – but the people on the economic development side often say that we can't do this because you've put too many restrictions on it, or else, if we do this and meet all the environmental standards, nobody is going to be able to buy our product because the cost will be so great. I don't know where the balance is. If I did, I would probably be Premier of the province and not Energy Minister. I don't know where it is but I think I have enough faith in the developers, the environmentalists and the people in general, the general public, that if we work together, if we cooperate, we can come up with a balance that we can accept and we can live with. And I hope that before my term is up that I will be able to come back to a conference such as this and say, 'We have found that balance where everybody is satisfied'. I hope that will happen, but I am not all that confident that it is going to happen quickly.

Anne Edwards: I talked about working toward recognizing all the costs involved in energy and in the economic development we use that energy for. I believe that in doing that, we will have to come to the point where we'll recognize some of the other costs that are there, which we didn't do a decade ago.

So I think that as we work that way, we are going to see what costs are and where we are going to have to say that we can't afford that, or we can only afford that if we do this; I think that we are going to need broad public involvement in those questions.

James Downey: I believe that a process has been started. I referred in my comments to the Sustainable Development Round Table, where all disciplines can come together from the government, from the private sector, from labour, from the environmental organizations, so that we can sit down and at least determine what are the costs of making certain decisions knowing what the outcome of a decision would be. I believe that the process we have now embarked upon will help Canada to become a country showing international leadership.

I do believe there is a way. I certainly haven't given up. I know that we've seen some tragedies in the past. We can't necessarily correct them, but I do think that as a democracy, that it's our responsibility to put a process in place that at least allows decisions to be made, knowing what is the cost of a decision that will come from this and whether we should proceed or not. I think the process is there and I'm confident in it.

Marc Eliesen: I think it's fair to say that in the context of 'where do we go from here,' that no one has the exact path because it isn't a black and white world out there. There are many shades of grey and there are many trade-offs. But I think what you have heard enunciated this afternoon from the three energy ministers is that conservation and environmental considerations clearly have much greater priority than they ever had before in the context of energy development.

Referring to my notes, I see that a number of references have been made emphasising the importance of the environment, that we have to be concerned about the environment in everything we do, that the cost of doing business has to include the environmental effects and must deal with what the economist refer to as the externalities. Regretfully, there isn't a common measurement today which everyone will accept. It applies not only to utilities or oil and natural gas corporations, but any kind of company in the marketplace, and clearly, that is the direction in which we are going, because it's generally accepted that those kind of costs should be included as the overall cost of doing business in the those particular areas.

I think you've heard references to a much greater consultation in the planning process rather than some edict coming from above. There are various methods that provinces have used and will be using in this area through regulatory commissions, through advisory commissions, etc. The trend is quite clear that there is now a much greater consultation process for energy development projects than has ever existed before, and that will continue. I think it's also a reflection on the fact that, whether we like it or not, a number of the decisions on public policy which used to be the prerogative of legislatures have been more and more referred to regulatory bodies. There's also the judiciary, and that's a recognition, without making a judgment whether it's good or bad.

The last point I would like to make relates to some of the themes that have gone on for the last couple of

days of efficiency, in terms of energy utilization, and I think there you've heard references to new technologies, some of which are clearly not economic now, but may be in the future. Some which are more limited in application, some are more widespread. You see references to the emphasis on trying to do more with what we have. That means utilizing existing plants, extending and rehabilitating rather than going onwards and building new things. I think the era of large mega-projects is less of a priority as opposed to the aspect of developing conservation and demand management as a method of limiting the degree to which we have utilized various energy forms, particularly electricity.

Those are some of the themes, I believe, that are coming out of the panel or perhaps have come out of some of the earlier discussions. I want to thank the three ministers for taking the time and allowing themselves to be more or less guinea pigs up here, subject to all your questions, and in trying to respond as honestly as they can to those questions. They have attempted to embarrass me in terms of the some the commercial decisions that Ontario has been involved in and I'm sure you noticed that I've deferred responding. I'd like, on your behalf, to thank them very much for their participation on this panel.

John Allan: Thank you, Marc, and thanks again to each of the panellists. I would now like to call upon Mr. Ray Hunt who is President and Chief Operating Officer of B.C. Hydro, for his closing remarks.

Closing Remarks by Ray Hunt

Ray Hunt: First of all, let me say how pleased B.C. Hydro is to have combined it's Fifth Annual Electric Energy Forum with the 14th National Forum of the Energy Council of Canada. I think the synergy has worked well.

1. Hydro Responds to Feedback

John Allan mentioned the matter of feedback, and I would like you to know that we do respond to the feedback that we receive from these Forums; we appreciate the feedback we receive from the participants. Particularly, we introduced a couple of changes this year. We added the microphones so that we could get some oral questions to support some of the written questions. We also had some stakeholder participation in the planning off the sessions, and I think that has provided some real added value. We also introduced the delivery of discussion papers to advanced registrants so people could prepare themselves and help focus some of the panel discussions. I think that also helped facilitate the workshops and make the process more efficient. So I would invite you to make sure you get those evaluation forms in and wanted you to know that we looked forward to your suggestions.

When Bob Wyman made his opening remarks, he commented that it was most important to B.C. Hydro's decision-making process that we reflect the values of the people that we serve and I would like to echo those comments. It's very important and there is no question in my mind that any public approval process will run more smoothly for Hydro if we can demonstrate to our regulators that we have adequate and active involvement with all our stakeholders.

Earlier today, Lenore Herb queried how the Forum results are integrated into B.C. Hydro's business plans, so I just wanted to re-assure her and you that the results of the workshop discussions are entered into the Proceedings and they are distributed and discussed within all Hydro's business units and will influence our activities. We consider that real value added to our process.

I was very impressed with the high quality of the presentations and the panel discussions at this Forum as B.C. Hydro, in our microcosm, moves into a new century. It was particularly instructive to see the bigger picture as portrayed by David Scott and Derek Davis. The very wide spectrum of representation that we heard, often with dramatically opposing points of view, all very articulately presented, allows B.C. Hydro to get a better understanding of energy and environmental issues not only in our backyard but within the global context.

2. Responsibility of Providing a Reliable Electricity Supply

Of course, I should put in a plug for a Chief Operating Officer, and my hope is that the representatives of the environmental and the consumer groups at the Forum develop an improved awareness of some of the very real challenges that we face in our role of providing a high level of reliability for your electricity supply. In other words, keeping the lights on, not only today but also in the future.

Last year's Forum theme was education. We had parallel participation by students, in panel discussion sessions parallel to the main panel discussions. This year, we asked students to participate in the main panel discussions, and I would like to particularly thank the Victoria area students for their participation.

3. Sixth Annual Electric Energy Forum, May 2 - 5, 1993

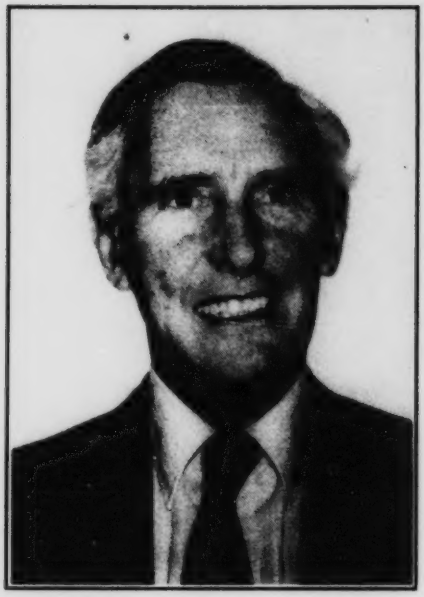
It only remains for me to take this opportunity to thank the remainder of you for your participation and particularly to invite you to join us at our next Forum, the Sixth Annual Electric Energy Forum, which will be held here at this same location, next year, from the 2nd to the 5th of May.

Thank you again.

Technology Transfer to Developing Countries
Canadian International Development Agency Special Session

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.



Colin Smallridge is the founder and principal consultant of C.G. Smallridge & Associates Inc., an Ottawa-based consulting firm specializing in business-government relations, energy, international trade development and political risk analysis. Prior to establishing his own firm, he spent 27 years with a major Canadian consulting engineering group specializing in the energy sector. Mr. Smallridge is a Director and past Chairman of the Energy Council of Canada, and continues to serve on the Committee on Energy Issues of Developing Countries of the World Energy Council. He received the Beaubien Award of the Association of Consulting Engineers of Canada for meritorious service to the industry.

Panel Discussions

Technology Transfer to Developing Countries

Sponsored by the Canadian International Development Agency (CIDA)

Panel 1: Energy Technologies Required by Developing Countries

Panellists
Eduardo Lobatón González
Saeed Akhtar Niazi
Swarng Champa
John Ritchie
Tom Drolet

Introduction of Panellist by Colin Smallridge

Good morning ladies and gentlemen. My name is Colin Smallridge and I am your chairman for this morning's special session dedicated to Technology Transfer to Developing Countries.

I would like, on behalf of the Energy Council of Canada, our host B.C. Hydro and the Canadian International Development Agency (CIDA), to welcome you to this session. I would like to recognize CIDA's assistance in enabling such a wide representation of delegates from the developing countries to join us, and in making our deliberations both pertinent and timely. I hope that the industry visits which are associated with overseas delegates' stay in Canada will be equally beneficial in forging our mutual interests.

This session is really a new initiative for the Energy Council of Canada, inasmuch as our national Energy Forums in the past have only dealt with domestic issues. However, in this increasingly interlinked world which, I think, we all realize is very much the case from the last two days of discussion, and in particular because of our location on the Pacific Rim, it seems appropriate to internationalize our scope. Those of you who have attended the Forum for the past few days have, I am sure, learned much of value from the excellent presentations and discussion we have had, and more will be said about this later.

Economic growth is closely linked to the provision of affordable and reliable energy supplies, particularly in the developing countries, where the demand is growing rapidly and further increases in energy requirements are inevitable in the years to come, as we've heard in the last few days. Electric power, has an especially vital role to play in the development process, both from environmental and economic standpoints. As was stressed in the previous sessions, emphasis must be placed on measures that will improve efficiency in production and use. The industrialized world has much to offer in assisting the developing countries to optimize their resources in a sustainable way.

Globally, it is important that the input requirements for development be minimized, in both energy and raw materials, by conserving our resources and reducing the environmental consequences of energy related economic activities. Various technological options are already available as short-term or medium-term measures for improving energy production efficiencies in the developing countries, and our speakers today will be talking about some of these. For example, in the power sector, plant generation improvement and rehabilitation, transmission and distribution loss reduction, interconnections and fuel substitutions are possible options.

Over the longer term, developing countries will have to rely on more advanced technological options currently being developed in the industrialized countries. This provides future opportunities to add state-of-the-art supply and end-use technologies such as gas turbine combined cycles, and an extensive range of clean coal technologies. These technologies are energy-conserving and can reduce the environmental impacts. Renewable energy options, such as wind, direct solar, biomass and biogas, can make modest but increasing contributions towards environmentally friendly energy development.

We will also deal with the issue of institutional reforms. Inasmuch as the energy sector in developing countries today is typically owned and controlled by government, the move towards more private sector participation, reduced regulation and innovative management along with appropriate technologies, will be very important in the future.

Today, we have chosen a broad subject, Technology Transfer to Developing Countries, which could and indeed has been, the sole focus of other energy meetings. The panellists will identify their technology needs in both the public and private sectors, briefly describe what is being done in the panellist's own region to transfer energy technologies and perhaps suggest the roles which industrialized countries and international institutions should play.

Our first speaker this morning will be Mr. Eduardo Lobatón González who is the Director of Equipment and Electrical Systems Division of the Electrical Research Institute in Mexico. In that role, he oversees projects associated with electrical efficiency, the distribution network, and the development of electrical equipment manufactured in Mexico. Prior to his current post, he carried out various engineering and managerial activities in the electrical equipment manufacturing industry, and was a business consultant in industrial engineering and general management. Mr. Lobatón was educated at the Monterrey Institute of Technology.

Please welcome Mr. Eduardo Lobatón González.

Developing Countries: A Case of Advanced Technology Application

1. Introduction

The increased consumption of energy has traditionally been linked with improved living standards. This relationship between Gross National Product and energy consumption has been recognized for years.

Recently, however, some adjustments have been made to the implicit relationship of GNP and energy consumption in the industrialized economies, to allow for the effects of energy efficiency improvements. Global environmental concerns, associated with the energy processes, have become a major issue.

Increasing per capita energy consumption, especially in electricity, has been experienced in the advanced economies during this century. Electricity has supported an ever-increasing industrialization level and higher living standards, a situation better seen in perspective when realizing that one quarter of the world population, living in industrialized countries, accounts for three quarters of global energy consumption.

The global environmental issues, as well as the availability of clean primary energy sources, are real concerns, that are underlined when the possibility of developing countries attaining higher levels of energy consumption are considered.

Clearly, increased levels of electrification is the preferred alternative, and it is not surprising that developing countries, striving to improve the welfare of their citizens, seek to enlarge the number of people that have access to electricity and also to provide the infrastructure required for industrialization.

In developing countries, the electrical industry is generally characterized by a steady growth in demand that must be generated, transported and delivered locally. However, considering the capital intensity of the electrical industry, the first question that arises is the availability of resources for investment, to enlarge the system for generation, transmission and distribution of electricity.

When the electrical industry is government-owned, as is the case in many developing countries, resources for investment come from fiscal revenues and credits, and thus have to compete in terms of priorities with other government programs, such as basic welfare, health, education, environmental and transportation programs. Competition can be fierce.

On the income side, considering government-owned industry, the price of electricity has sometimes been managed as a macroeconomic variable to influence inflation-controlling efforts or as a further incentive to more rapid industrialization. Providing electric energy to the general population at subsidised cost, as a means for improving the standard of living is generally accepted, but can be a very costly proposition. It is not at all profitable in many cases, such as the poor areas in urban or rural communities.

The presence of an informal economy in many countries, aggravates the financial situation of the electrical industry, by stimulating the demand for electricity. There are more people demanding the service or increasing their living standard by utilizing more energy, but without generating more fiscal income, which is needed for investing in additional capacity in the electrical system.

The increased electricity demand and scarcity of investment funds impose heavy loads on the electrical industry in developing countries. Some of these can be addressed with new technological developments or the adaptation of the existing technology to the peculiarities of the particular economy. Explicit consideration to the environment and energy efficiency must be included.

The contribution of technology in the electrification processes can be substantial. However, as existing technology has been mainly developed in industrialized nations, to address their particular needs, it is necessary

to adapt, modify or create new technology to better solve the energy problems of developing countries.

2. The Electrical Industry in Developing Countries

2.1 Generation

Due to the amount of capital required, consideration should be given to the size of the power station to be installed. The commitment of scarce resources to large single projects should be carefully considered. The economics of scale are not guaranteed, once the cost of financing large projects with long lead times is factored in. Further, large projects with generating capacity in excess of short-term needs, are still more costly if power plant factor is taken into account.

Clearly, the ideal would be to follow a modular approach so the amount of financial resources is more manageable, rather than addressing the increment of generating capacity problem with the single large project alternative. Fuel cells are clearly an alternative from this point of view. To profit from the advantages of nuclear energy will require the development of new technology, so as to make smaller-sized stations a viable alternative.

In thermal stations, the energy-saving potential of the new combined cycles should be stressed. The savings in primary energy, as well as the reduction in emissions, make high-efficiency stations a primary candidate in thermal power generation. Again, the economies of scale must be dealt with in order to make high-efficiency cycles economically available in smaller sizes.

Cogeneration should also be taken into consideration. Energy savings can be important. Adoption of economic small-size equipment should be increased.

Better construction techniques are required to generally reduce lead times. Prepackaging and prefabrication of components manufactured to closer tolerances attained with modern computerized design and manufacture must produce better project economics.

On the operational side, predictive maintenance techniques and life extension programs should be implemented. Advanced control and automation systems in power stations, retrofitted to existing equipment, can ensure an optimized operation and permit improvements in reliability, efficiency and equipment utilization.

2.2 Transmission

Savings can be obtained in right of way costs by means of using compact transmission line technology, specially in the 69 kV to 150 Kv range. New non-ceramic insulators with improved performance in polluted environments, as well as new lightning protection devices, can improve the reliability of the network, reducing the need to build in redundancy.

The flexible AC Transmission line technology, as defined by EPRI, will make the design and operation of transmission networks less costly and more reliable. Existing transmission lines can be operated closer to the temperature limit reliably, thus avoiding the need for new transmission lines. Isolated systems can be interconnected without diminishing overall reliability.

Direct current and extra high voltage transmission systems are required to economically transport large amounts of site-conditioned energy to consumption centres or interconnected systems.

On the operational side, techniques such as real-time energy management systems can optimize the primary energy utilization and provide better tools to operate the generation and transmission systems.

2.3 Distribution

The distribution process is frequently overlooked when discussing technology. It is usually considered mature. Innovations or technology developments in industrialized countries are mainly oriented towards improving the quality of an already good service level, as per developing countries standards. Efforts are being made towards distribution automation, remote meter reading, better and more powerful meters to handle a multitude of billing alternatives. Problems created by electronic devices through the generation of harmonics are a worry.

However, in many Developing Countries, the priorities lie elsewhere, as can be elicited from the description of some characteristics of the distribution process.

One of the manifestations of development, as has been mentioned, is urbanization, another is the electrification of rural areas. Both present unique problems.

The rapid urbanization process calls for a very dynamic distribution network and a system that is in continuous development. The pressing need to provide the electric service to new customers and the scarcity of financial resources, frequently result in the extension of the existing network beyond the limits called for by good engineering practice. Penalties are paid when this happens. Long feeders and secondary lines prevail, causing high losses and poor voltage regulation. The enlarged area served by a single feeder has poor service reliability, as the occurrence of one fault affects a larger area. Transformer life is decreased as protection devices are difficult to coordinate in a changing network or, until recently, were not available for long secondary lines.

Providing electrical service to rural areas poses another set of problems. The major one may be financial, as the expected revenues are not enough to justify the investments associated with the delivery of electricity. Furthermore, the geographical dispersion of the load adds a burden to the quality of service and the operating costs; it can take days for the utility to know that a fault occurred in a remote location and to restore service.

Almost everywhere, the billing process involves meter reading, invoice issue and delivery, and collection. This is a costly procedure that can be justified when the amount collected is high enough. However, in many instances in Developing Countries, the amount collected is not enough to pay the cost associated with the billing process, both in the rural areas as in the poorer section of urban developments.

3. New Technologies

To tackle these problems, new technologies must be developed. Existing new technologies that have not received widespread application in industrialized countries, because of low return on the investment, can make sense in the above described environment. Some examples can be mentioned.

3.1 Distribution Automation Systems

Fault location and remote operation of switching equipment can substantially improve the level of service provided. By directing maintenance crews to the exact location, repair times can be shortened. Remote switching equipment can reduce the affected area by a fault.

One of the indices utilized to measure the quality of the service is the Time of Interruption per User. It is usually expressed as the time in minutes per year that a customer does not have electricity. In most industrialized countries the index varies between 10 and 60 minutes. In Developing Countries, it is not infrequent to find times in the hundreds of minutes and sometimes in the thousands. The following can also be considered:

Remote operation of capacitor banks can improve the voltage profile, to attend the specific needs in a dynamic network.

Remote reconfiguration of the network, making it feasible to supply a line from different substations, can result in less overall investment in backup equipment.

Remote tuning of protection devices, to adapt to frequently-changing electrical conditions.

3.2 Support Systems Based on Personal Computers

A recent innovation are support systemsbased on personal computers; they can be a material assistance in:

Distribution network planning, to optimize the design, dimensioning and location of new substations.

Feeder design optimization, including dimensioning and location of transformers, capacitor banks, protection and switching devices.

Geographical data bases describing the electrical network, to support the planning activity as well as the management of equipment and maintenance.

Protection coordination can be implemented, even in a rapidly changing electrical geometry, to extend the life of installed equipment.

Simulation programs to analyze and optimize investments associated with the reduction of losses.

Reconstruction of old or failed distribution transformer programs. Small distribution transformers are usually discarded in the advanced economies, due to the high labour costs associated with repairs. On the other hand, the repairs, which usually involve reproducing the failed equipment design, may not take full advantage of the materials salvaged or of the new insulation available, if the utility lacks design capabilities or must pay the high cost of redesigning each case manually. A computer program can optimize the utilization of the usually undamaged steel core by designing the largest coils that can be used with the incorporation of new materials. In this manner, additional transformer capacity can be obtained at reasonable costs.

3.3 Rural Electrification

Photovoltaics can be an economical alternative to provide minimum electrical energy to small rural communities. New concepts, such as using voltage dividers, can provide energy economically to small rural communities, located near transmission lines, thus avoiding the cost of a conventional substation.

3.4 Devices

Microcomputer-based metering devices can be used in prepayment schemes, a viable solution to the high cost of the billing process, as described above.

Secondary side protection of post-type distribution transformers is required, especially where it is necessary to install long secondary lines. Such devices can diminish the number of failed distribution transformers.

New non-ceramic insulators and lightning protection devices can improve the reliability of the network and reduce investments.

Retrofitting old oil breakers with vacuum or SF6 interrupting chambers can make economic sense, especially when the short-circuit capacity changes rapidly, as new generation is added and the network is enlarged.

4. Efficiency and Conservation

It would be an incomplete picture if consideration is not given to the activities related with Demand Side Management and more specifically to energy-saving technologies. Developing countries should incorporate as part of their energy planning activities, those related to energy efficient utilization.

Although some technologies are already available, some comments can be made on these.

4.1 Distribution Automation Systems

These can also be used to manage interruptible loads for peak-shaving programs.

4.2 Compact Fluorescent Lighting Fixtures

These are costly. It is not economically sound for a customer to buy and install presently available devices. Actually, they are used in some countries mainly because electrical utilities give them away or subsidize the price. Rebates or giveaways have stimulated the usage but have not forced the prices down enough yet.

4.3 High-efficiency Electric Motors and Home Appliances

The technology to produce higher efficiency motors already exists. However efficient motors are more expensive. Alternative means to the usual economics must be implemented, to encourage the adoption of the higher-efficiency motors.

The same may be said about home appliances such as refrigerators and air conditioning equipment.One viable alternative is to implement mandatory minimum efficiency standards.

5. Training

Finally, mention must be made of personnel training requirements. Better training tools are required to insure and maintain operational expertise.

Especially in power plant and electrical system operation, the utilization of partial or full-scale simulators is required, as other training tools are not as effective. Also, the extensive use of expert systems can enhance the expertise of operational personnel.

6. Conclusions

The particular requirements of the electrical systems in developing countries determine the need to adapt, modify or create new technology, to better solve the energy needs. Advanced technologies can play a crucial role in the electrification process, resulting in better utilization of scarce resources.

Thank you.

Colin Smallridge: Thank you very much, Mr. Lobatón.

Our next speaker is Mr. Saeed Akhtar Niazi, who is the General Manager, Planning, in the Planning (Power) Division of the Water and Power Development Authority in Pakistan. He has held many senior administrative and engineering positions with that utility and has been responsible for the operation, the maintenance and the construction of all the hydro-electric projects in Pakistan. Mr. Niazi also served as a UNIDO 'Expert on Mission' for hydro power projects in Burkina Faso, Africa. He has published several papers on technical and economic aspects of hydroelectric generation in professional journals and conference proceedings. As well, he has received numerous awards, including a Special Medal from the Government of Pakistan for meritorious service on the Warsak Dam, and the Congress Gold Medal for the best paper on hydroelectricity, from the President of Pakistan.

Please welcome Mr. Saeed Niazi.

1. Introduction

There's a wide gap between the technological level of the developed industrialized countries and the less-developed or developing countries. Unfortunately, this gap is widening rather than narrowing, barring few exceptions of course. Unless this serious situation is remedied, the rapid growth of technology in the developed world will leave the developing world even farther behind. Pressures of rapidly increasing population in the less-developed world will further aggravate the already not-very-happy situation, and the day may come when a globally disastrous situation may develop.

The developed world must realize the long-term mutual benefits of sharing technology with densely populated developing countries in order to boost their standard of living. Imagine the quantum leap in global industrial and commercial activity if the four billion people living in the developing world achieve more or less the same purchasing power as the one billion now living in the developed countries. Without doubt, those who transfer technology would reap their share of the harvest through increased economic activity.

The needs of the energy technologies may vary from country to country. Some may be rich in fossil fuels like oil, gas and coal. Others may have abundance of hydro power resources and still others may have both or none of the above conventional resources. Fossil fuel energy resources in some cases may be so ill-defined and obscure that a high level of technology may be required for their exploration. The quality of certain fuels may not be good and may require extensive processing. With the depletion of the fossil resources and all available hydropower resources being fully developed in certain cases, research and development efforts involving considerable costs may be needed for development of non-convention technologies like photovoltaic solar panels, wind energy, etc.

The requirements of energy technology and their transfer to developing countries is so complex and varied and that their summation and description is not possible in this limited presentation. It is therefore more appropriate to restrict the description to Pakistan only.

2. Pakistan's Technology Requirements

Pakistan, a developing country, gained it's independence in 1947, with the partition of the Indo-Pakistan sub-continent. Its energy scenario remains bleak 45

years after, despite the fact that big strides have been made in the field. At the time of partition, Pakistan had only about 130 megawatts of generation capacity, it now has 10,000. However, Pakistan is very short of power. Per capita electrical energy consumption is dismal; only 350 kilowatt hours per year compared with a North American average of 12,000 kilowatt hours per year.

Pakistan is poor in fossil fuel resources. Oil production, despite great efforts, is hardly enough to meet one-third of the country's requirements. Coal, though available in reasonable quantities, is of poor quality. Gas reserves are significant but far from unlimited. Pakistan is, however, lucky to have been gifted with an abundance of hydro-power resources.

For development of all these energy resources, Pakistan depends on developed countries all the way from seismic surveys, to the import of drill rigs for oil exploration, purchase of power plants, whether thermal or hydro, and the building of the dams. For the sake of brevity, the discussion will be restricted to only the electric power sub-sector.

Pakistan, like many other developing countries is currently attempting to transform its stagnating, overly-controlled economy, into a dynamic, forward-looking and industrialized one. In order to achieve this objective, the demand of electricity in Pakistan is expected to rise to something like 40,000 MW in the next two decades and, as I told you earlier, the present capacity is only about 10,000 megawatts. Hence a conservative estimate of the amount required for meeting this demand is something like 40 billion dollars, plus the transmission distribution cost which could double this cost. Whether a country like Pakistan can afford to allocate this enormous amount of capital for electricity generation, in the presence of numerous other equally high-priority requirements, presents a very complex dilemma.

Pakistan is almost totally dependent on foreign sources for the construction of its power projects and manufacture of power equipment, which become expensive for several reasons including high manufacturing and labour costs in the developed countries, as well as long-distance shipping costs. The nation is required to provide large amounts of very scarce foreign exchange to pay for these imports. One way to reduce the cost is to develop local know-how by a prudent, methodical and continuous transfer of technology from the developed countries. Technology transfer is not just one of the ways, it is the only way, in fact, that we can do it.

3. Technology Needs

Pakistan's needs for the transfer of technology in the various aspects of the power industry are urgent. By way of illustration, but not limited to the following, are:

3.1 Construction of Dams

Pakistan has built three large dams and hydroelectric facilities with foreign assistance but has not acquired sufficient technology to proceed with construction of a further one on its own. One view was summed up in a governmental committee constituted to look into the problem. The committee expressed its disappointment that, despite having built dams like Warsak, Mangla, and Tarbela, Pakistan has still to seek foreign assistance for the construction of future dams. With such projects behind them, Pakistanis should by now have become the most sought-after dam designers and builders anywhere in the world. The committee felt that this was because of absence of institutional efforts in the transfer of technology.

3.2 Powerplant and Equipment Manufacture

Pakistan needs to develop its own power generation resources at an annual growth rate of 10 per cent. For this purpose, it will have to construct highly efficient thermal power stations. The additional annual generation requirement is presently 1,000 megawatts which will grow to about 2,000 megawatts by another decade. This requirement can sustain the power equipment manufacturing facilities for turbines, generators, boilers, transformers, switchgear, hydraulic penstocks, valves, gates, cranes and allied power plant equipment. In fact, existing infrastructure in Pakistan can be tuned to cater for these requirements. Local manufacture is essential also to keep the prices of power equipment down, utilizing lower cost labour and other allied facilities that are available in Pakistan. This will result in keeping electrical tariffs down to match the purchasing capacity of the populace.

Developed countries would do well to generously enter into licensing arrangements and/or joint ventures. Such a step would be to the mutual benefit of highly-populated developing countries by presenting an essentially unlimited market for the power plants and later the downstream industries.

3.3 Energy Conservation

Energy Wastage

Developing countries like Pakistan are not only short of electricity generation but also there is a great wastage in the inefficient use of energy-intensive equipment, as shown in the following tabulation:

Use	Present Efficiency	Achievable Efficiency
Industrial Boilers	Below 70%	82%
Agricultural Pumping		
Diesel	5 - 7 %	15 - 20%
Electric	20 - 25%	40 - 45%
Lighting	18%	21%+
Electric Motors	68 - 83%	83 - 95%
Electric Fans	35%	65 - 70%

Local research-oriented agencies are doing some work, but it leaves much to be desired. It is not prudent for a developing country to spread its limited human

and financial resources thinly to achieve the level of technology which have already been achieved by the developed countries. A generous attitude towards such technology transfers could be mutually beneficial.

Lights and Other Energy-Saving Items. Developing countries continue to use inefficient incandescent lamps although highly efficient but as yet very expensive bulbs are now in use in developed countries. Local manufacturing facilities with imported know-how would greatly facilitate adoption and possibly reduce the cost of energy-efficient bulbs, increasing their use and ultimately saving energy in Pakistan.

4. Conclusion

The energy technology requirements in the power sub-sector, from Pakistan's perspective, may be summed up as shown below; at the government to government level, as well as at the industry to industry level:

- Technology transfer should be more liberal and generous. Developed countries should keep the long-term benefits in view rather than short-term gains. Humanitarian aspects must also be kept in view.
- Both the developer and the recipient, and their respective governments, should ensure that the transfer of the technology is institutionalized. Massive on the job training is needed for engineers, scientists, technologists and technicians.
- Adaptive research may be a continuous process to remove technical blocks as soon as they arise. It should ensure that the recipient remains permanently connected to the state of the art.
- Joint ventures in construction and manufacturing may greatly help the developing countries to reduce energy development costs and reduce hard currency requirements to a level commensurate with buying capacity of its populace.

Thank you.

Colin Smallridge: Thank you very much, Mr. Niazi.

Our next speaker is Mr. Swarng Champa, who is the Deputy General Manager of Hydro Power and Transmission with the Electricity Generating Authority of Thailand (EGAT). In Mr. Champa's long career with EGAT, he has worked in many departments including Services, Hydro Power Development and Civil Maintenance. He was Superintendent of the Srinagarind (Ban Chao Nen) Hydroelectric Project and Director of the Srinagarind Dam and Power Plant. Mr. Champa is a member of both the Engineering Institute of Thailand and the South-East Asian Society of Soil Engineers. He has published several papers on the Srinagarind Dam.

Please welcome Mr. Swarng Champa.

Electricty in Thailand

1. Introduction

Thank you, Mr. Chairman. Ladies and gentlemen, it is my pleasure of being invited to participate in this Energy Forum. I would first like to talk a little bit about our power industry in Thailand, and then conclude by saying a few words about on cooperation and technology transfer.

In most developing countries today, the critical issue is that the demand for electric power is continuing to expand faster than the growth of supply, while the energy development is constrained not only by traditional financial, technical and manpower related impediments, but also by heightened environmental concerns. Thailand is also the one among the developing countries most likely to become increasingly industrialized and urbanized.

Electricity Generation in Thailand is the responsibility of the state-owned Electricity Generating Authority of Thailand, while the distribution is carried out by two State enterprises; the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA). The former is responsible for the retail distribution of electricity in Bangkok, Samut Prakarn and Nonthaburi, while the latter is responsible for distribution in the rest of Thailand. At present, the private generation and distribution of electricity are not allowed under the law. A schematic diagram of the principal electrical facilities in Thailand is shown in **Figure 1**.

Generating capacity is presently about 10,542 MW, supplying a peak demand of 8,877 MW and producing about 55,000 GW·h of electrical energy per year. 40 per cent of this electricity is currently generated from natural gas produced in Thailand, about 25 percent is produced from domestically mined coal (lignite) and the remainder is produced from hydro power (10 percent) and fuel oil (24 per cent). Imported electric energy from Laos and Malaysia amounts to about 1 per cent. (See **Figure 2**).

The major problems faced by the sector are that demand is growing very rapidly and most of the increase in generating capacity will have to come from coal. Natural gas resources are simply not large enough to meet forecast demand growth. Indigenous coal resources are lignitic, low in quality and high in sulphur. These resources will not be enough to provide for the forecast demand over the next decade and imported coal and natural gas will be needed, with increased imports of oil.

The development of the electrical generating system along with the increase in demand will be a major factor in the achievement of high levels of future economic growth. Shortfalls in other areas of energy production can be provided for by imports. While this may not be desirable, in terms of the exports which would need to

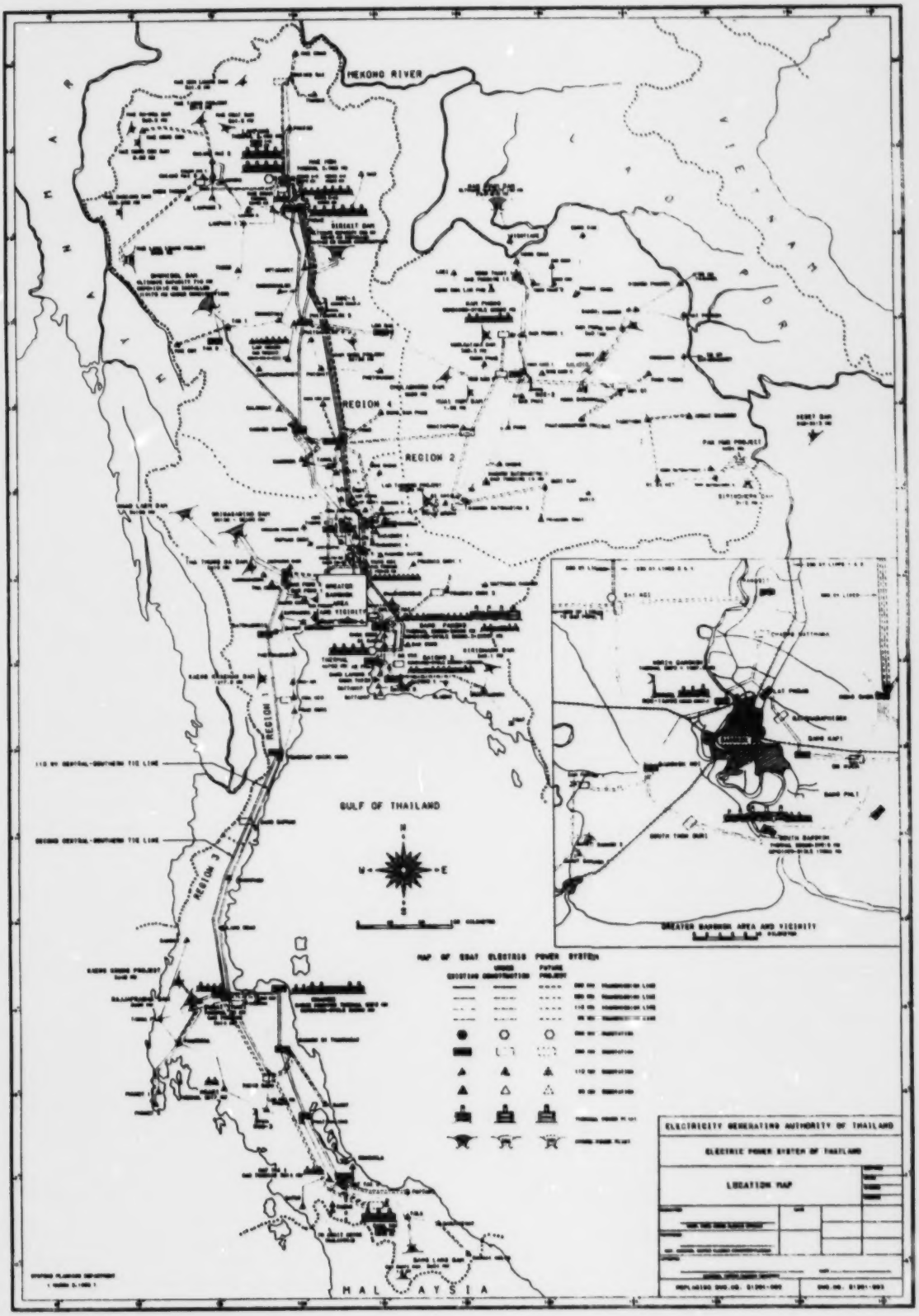


Figure 1: Electric Power System of Thailand

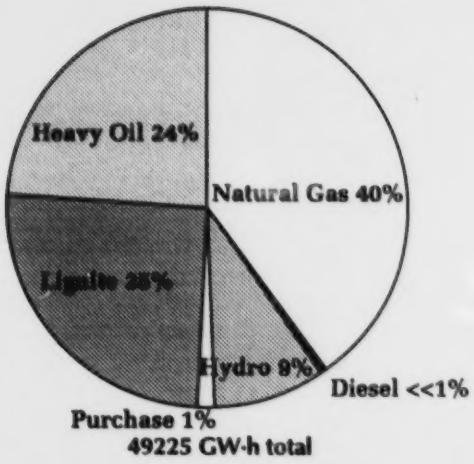
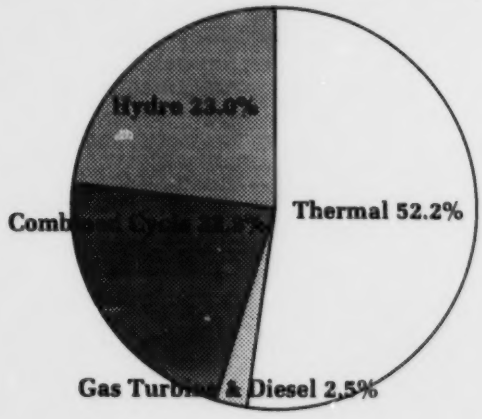


Figure 2: Energy Generation by Fuel Type, Fiscal 1991



	MW
Total installed capacity	10541.9
Peak generation (7 Apr 92)	8713.2
Reserve margin (16.1 %)	1401.7
Prior year peak generation (17 Sept 91)	8045.0
Growth from September 1991	668.2

Figure 3: Present Status

be produced to pay for such imports, it need not necessarily place a major constraint on economic growth. A shortfall in electrical generating capacity, however, would constitute a major constraint. The growth of many industries, including the manufacturing industries which are now becoming the engines of Thai growth, require reliable supplies of power.

The electricity industry may also be a source of pollution in Thailand. The exploitation of lignite deposits and the burning of fossil fuel in power stations will cause a range of particulate, gaseous and solids emissions. The industry will need to acquire a range of skills in this area, covering the design and operation of high-efficiency power stations which minimise environmental impact. Further water resources developments, either for hydro power alone or multipurposes, are a very controversial issue, when taking into consideration all the ecological and environmental consequences, even though the hydro power itself is a clean and renewable energy source.

2. Electricity Demand

The demand for electricity has grown at a very rapid pace over the past decade. Growth throughout the 1980s has averaged 12 per cent per annum compared to an annual average GDP growth rate of 8 per cent.

In recent years, the industrial sector has become the major engine of economic growth and the major consumer of electricity in Thailand. Recent growth has also been fuelled by substantial increases in residential and urban consumer demands. EGAT's daily load curves are showing an increasingly pronounced evening peak. There appears to be little scope in the near future for suppressing the contribution of small consumers to the daily peak through conventional load management techniques. Significant opportunities do exist, however, for reducing the demand of large industrial consumers at system peak times through the introduction of time-of-day tariffs (which EGAT has already introduced) and the introduction of supply and demand-side management techniques.

A sharp increase in GDP growth rates in the late 1980s has resulted in much higher than expected growth in electricity demand than the 13-15 per cent growth experienced from 1987 to date. Annual demand increased by more than 18% in 1990. The present outlook is for continued strong economic growth and demand forecasts have been revised in the light of recent developments. **Table 1** shows the most recent forecast developed by the Load Forecast Working Group.

In line with the country's high economic growth rate, an average of 10% per year in the Sixth Five-year National Development Plan period (1987-1991), the power requirement increased to 8,045 MW at the end of this period (1991), which was almost double of that required at the end of the Fifth Plan period (1986). The load forecast, which was revised in September 1991, indicates future peak demands of 13,075 MW and 19,000 MW at the end the Seventh and the Eighth plans (1996 and 2001), respectively. These demands represent average annual growth rates of 10.2% for 1992-1996 and 7.8% for 1997-2001.

3. Generating Capacity

Figure 3 shows the present status of each category of generation in the total installed capacity of 10,542 MW, which consists of 23% hydro, 52% thermal, 22% combined cycle and 3% gas turbine and diesel plants.

4. Power Development Plan

4.1 Ongoing Projects

Most of the projects that will be in operation over

Table 1: Total EGAT Generation Requirement (Base Case)

Fiscal Year	Peak Generation MW	Increase MW	Increase %	Energy Generation GW·h	Increase MW	Increase %	Load Factor %
				Actual			
1981	2588.7	171.3	7.09	15959.97	1206.24	8.18	70.38
1982	2838.0	249.3	9.63	16881.95	921.98	5.78	67.91
1983	3204.3	366.3	12.91	19066.30	2184.35	12.94	67.92
1984	3547.3	343.0	10.70	21066.44	2000.14	10.49	67.79
1985	3878.4	331.1	9.33	23356.57	2290.13	10.87	68.75
1986	4180.9	302.5	7.80	24779.53	1422.96	6.09	67.66
1987	4733.9	553.0	13.23	28193.16	3413.63	13.78	67.99
1988	5444.0	710.1	15.00	31996.94	3803.78	13.49	67.09
1989	6232.7	788.7	14.49	36457.09	4460.15	13.94	66.77
1990	7093.7	861.0	13.81	43188.79	6731.70	18.46	69.50
1991	8045.0	951.3	13.41	49225.03	6036.24	13.98	69.85
Average Growth 1982-91	-	545.63	12.01	-	3326.51	11.92	-
				Forecast			
1992	9000.0	955.0	11.87	55475.00	6249.97	12.70	70.36
1993	9924.0	924.0	10.27	61339.00	5864.00	10.57	70.56
1994	10892.0	968.0	9.75	67561.00	6222.00	10.14	70.81
1995	11946.0	1054.0	9.68	74522.00	6961.00	10.30	71.21
1996	13075.0	1129.0	9.45	81741.00	7219.00	9.69	71.37
1997	14205.0	1130.0	8.64	89307.00	7566.00	9.26	71.77
1998	15354.0	1149.0	8.09	96591.00	7284.00	8.16	71.81
1999	16531.0	1177.0	7.67	104431.00	7840.00	8.12	72.12
2000	17765.0	1234.0	7.46	112653.00	8222.00	7.87	72.39
2001	19000.0	1235.0	6.95	121083.00	8430.00	7.48	72.75
2002	20219.0	1219.0	6.42	129455.00	8372.00	6.91	73.09
2003	21482.0	1263.0	6.25	138322.00	8867.00	6.85	73.50
2004	22795.0	1313.0	6.11	147509.00	9187.00	6.64	73.87
2005	24150.0	1355.0	5.94	157137.00	9628.00	6.53	74.28
2006	25515.0	1365.0	5.65	166999.00	9862.00	6.28	74.72
Average Growth 1982-1986	-	318.44	10.06	-	1763.91	9.20	-
1987-1991	-	772.82	13.99	-	4889.10	14.71	-
1992-1996	-	1006.00	10.20	-	6503.19	10.68	-
1997-2001	-	1185.00	7.76	-	7868.40	8.18	-
2002-2006	-	1303.00	6.07	-	9183.20	6.64	-

from the Working Group Load Forecast, September 1991

the next 5 years are already under construction or are committed for implementation. These ongoing projects consist of 20 power plant projects at 11 locations totalling 5,305 MW, as detailed in **Table 2**, with the total expenditure of Baht 97 billion or US$ 3.8 billion.

4.2 New Projects in the Seventh & Eighth Plans (1992- 2001)

Since most power projects require a long lead time, during the Seventh Plan (1992-1996), 16 new power plant projects will be constructed, totalling 8,266 MW, with a total capital expenditure of Baht 296 billion or US$ 11.6 billion, pending Government approval. **Table 3** summarizes the Seventh Plan period projects. These projects will start in the Seventh Plan period and will be completed in the Eighth or Ninth Plan periods. Only 3 of the 16 projects are hydroelectric; namely, four 250 MW pumped storage units at Lam Thakong, two 80 MW units at Mae Lama Luang and two 13 MW run-of-river units at Mae Taeng.

The other 13 are thermal projects, including two phases of peaking gas turbine units at Wang Noi (1,000 MW in total), two 150 MW atmospheric fluidized-bed lignite-fired units at Mae Kham, three 700 MW imported coal-fired units at Ao Phai , four new 700 MW oil/coal-fired units on the west coast of the Gulf of Thailand, and two 300 MW lignite-fired thermal units at Saba Yoi.

Table 2: Ongoing Projects

	Capacity MW	Expected Commissioning Date
Hydroelectric Projects		
Bhumibol		
Renovation, Units 1 & 2	2 x 70	Nov 92-July 93
Pak Mun, Units 1 to 4	4 x 34	June 94-Nov 94
Sirikit, Unit 4	125	March 95
Bhumibol, Unit 8	175	Dec 95
Kaeng Krung, Units 1 & 2	2 x 40	Dec 96
Thermal Powerplant Projects		
Rayong		
Combined Cycle Block 1	102	Jan 92
Bang Pakong		
Thermal Unit 3	600	Jan 92
Combined Cycle Block 3(ST)	99	Feb 92
Rayong		
Combined Cycle Block 2	102	Mar 92
Bang Pakong		
Combined Cycle Block 4(ST)	99	Apr 92
Rayong		
Combined Cycle Block 3	102	May 92
Nam Phong		
Combined Cycle Block 1(ST)	113	June 92
Bang Pakong		
Thermal Unit 4	600	Dec 92
Rayong		
Combined Cycle Block 4	308	Nov 92-Sept 93
Nam Phong		
Combined Cycle Block 2	355	Jan 93-May 94
South Bangkok		
Combined Cycle Block 1	674	Dec 93-Sept 94
Kanom		
Combined Cycle Block 1	300	May 95
Mae Moh		
Thermal Unit 12	300	May 95
Thermal Unit 13	300	Nov 95
Ao Phai		
Thermal Unit 1	700	Jan 97
Total Capacity	**5305**	

For the Eighth Plan period (1997-2001), future installations totalling 13,700 MW are tentatively projected, consisting of eight 300 MW lignite-fired thermal units, five 1000 MW lignite-fired thermal units, five 1000 MW oil/coal-fired thermal units, six 1000 MW nuclear units, and one pumped storage hydro plant (2 x 150 MW) for a total capital expenditure of Baht 543 billion or US$ 21.3 billion.

This power development plan has been formulated to utilize domestic resources such as lignite, natural gas and hydro potential as much as possible.

However, such natural resources are limited and seem to be all committed for utilization at present. Therefore, it has been decided to employ imported coal

Table 3: Seventh Plan Period (1992-1996) Powerplant Projects

	Capacity MW	Proposed Commissioning Date
Hydroelectric Projects		
Lam Thakong Units 1 & 2	2 x 250	Oct 1997
Mae Lama Units 1 & 2	2 x 80	Feb 1999
Lam Thakong Units 3 & 4	2 x 250	Feb 2001
Thermal Powerplant Projects		
Wang Noi		
Gas Turbines 1 to 6	6 x 100	Jan 95-Apr 95
Gas turbines 7 to 10	4 x 100	Jan 96-Mar 96
Mae Kham AFBC 1	1 x 150	June 1997
AFBC 2	1 x 150	July 1997
Ao Phai		
2	1 x 700	July 1997
3	1 x 700	Mar 1998
New Oil/Coal-Fired		
1	1 x 700	Oct 1998
2	1 x 700	Apr 1999
3	1 x 700	Oct 1998
4	1 x 700	Apr 2000
Saba Yoi 1	1 x 700	Oct 2000
Ao Phai 4	1 x 700	Apr 2001
Saba Yoi 2	1 x 700	Oct 2001

as well as introducing nuclear power plus encouraging joint development of the international rivers and seeking imports of natural gas from neighbouring countries. The increase of imported fuel oil is, of course, to be included in the future generation. The details of the future projects and their capital expenditures are shown in **Tables 4 and 5.**

5. Primary Resources for for Electric Power

5.1 Hydro Power

The inventory survey of exploitable hydro potential indicates up to an average of 16,850 Gw·h per year, of which only 5,900 Gw·h (35%) have been exploited by the currently installed capacity of 2,478 MW. There are also two international rivers, the Mekong and Salween, which form the borders between Thailand and Lao PDR and Myanmar. They have an estimated exploitable potential of 43,460 GW·h and 37,140 GW·h per year, respectively. Water resources development faces serious social and environmental problems because of the relocation and resettlement of people facing inundation and the loss of agricultural land and forest.

5.2 Oil and Gas

Thailand has a reasonable potential for further oil and gas development. Some 500 million barrels of crude oil and condensate and 8.6 trillion cubic feet of natural gas have been proven, out of recoverable reserves estimated to be 16.1 trillion cubic feet. Oil production provides less than 10% of our annual liquid fuel requirement. Therefore, Thailand is dependent on imports for

Table 4: Eighth Plan Period (1997-2001) Projects

	Capacity MW	Proposed Commissioning Date
Hydroelectric Projects		
Nam Khek Pumped storage		
Units 1 & 2	2 x 150	Apr 2002
Thermal Powerplant Projects		
Lampang		
Unit 1 & 2	2 x 300	Mar 2002
Unit 3	1 x 300	July 2002
Unit 4	1 x 300	Nov 2002
New Thermal Unit 1	1 x 1000	Jan 2003
Lampang		
Unit 5	1 x 300	Mar 2003
Unit 6	1 x 300	July 2003
New Thermal Unit 2	1 x 100	July 2003
Lampang Unit 7	1 x 300	Jan 2004
New Thermal Unit 3	1 x 1000	Jan 2005
Lampang Unit 8	1 x 300	July 2004
New Thermal		
Unit 4	1 x 1000	Jan 2005
Unit 5	1 x 1000	July 2005
Nuclear		
Unit 1	1 x 1000	Apr 2006
Unit 2	1 x 1000	Oct 2006
Unit 3	1 x 1000	Apr 2007
Unit 4	1 x 1000	Oct 2007
Unit 5	1 x 1000	Apr 2008
Unit 6	1 x 1000	Oct 2008
Total Capacity	13700	

the remaining 90%. For present electricity production (1992), a daily average of 8 million litres of oil and 830 million cubic feet of domestic natural gas are required; this will increase with future system expansion. It is expected that for the joint developments with neighbouring countries, additional amounts of natural gas will have to be imported.

5.3 Lignite and Coal

There are various undeveloped lignite resources in Thailand. The total geological reserve is estimated at about 2,069.2 million tonnes. The significant reserves located in the North are about 1,598.3 million tonnes, equivalent to 77.2% of the total reserves ; and the other 470.9 million tonnes (22.8%) is located in the South. The estimated mineable reserve of lignite is expected to be about 1,017 million tonnes located in the following areas:

Deposit Area	Mineable Reserves (million tonnes)
Mae Moh	812
Saba Yoi	137
Wiang Haeng	85
Sin Pun	23
Krabi	20
Total	1,017

Table 5: Capital Expenditures

Five-Year Plan	Capital Expenditures* FC	LC	Total
Seventh Plan			
1992	14558 (559)	13585 (522)	28143 (1082)
1993	26154 (1005)	20187 (776)	46341 (1783)
1994	40919 (1573)	30017 (1154)	70936 (2727)
1995	42012 (1615)	38601 (1484)	80613 (3199)
1996	34357 (1321)	35610 (1369)	69967 (2690)
	158000 (6076)	138000 (5307)	296000 (11383)
(1992-96)	53%	47%	(00%
Eighth Plan			
1997	39692 (1526)	39977 (1537)	79669 (3063)
1998	36721 (1412)	43042 (1655)	79763 (3067)
1999	44042 (1693)	47095 (1811)	91137 (3504)
2000	69287 (2664)	58563 (2252)	127850 (4916)
2001	90258 (3471)	74323 (2858)	164581 (6329)
	280000(10769)	263000 (10115)	543000(20884)
(1997-2001)	52%	48%	100%
Total	438000 (16846)	401000 (15423)	839000(32269)
(1992-2001)	52%	48%	100%

Costs are in millions of Baht (millions of US$)
Exchange rate: US$1 = 26 Baht
* Excluding Value Added Tax

The present utilization of lignite from Mae Moh and Krabi Mines for power generation is an average of 36,600 tonnes per day. This will increase with the expansion of lignite-fired power plants, as projected for the future, while at the Saba Yoi deposit, detailed explorations are now under way. It is projected that imported coal will be utilized for power production in the future.

6. Co-operation and Technology Transfer

Power development projects require various kinds of expertise for planning, investigation, design, implementation, operation and maintenance as well as the appropriately integrated considerations and management of the ecological and environmental consequences locally, regionally or globally. As already stated, most of the developing countries always face deficiencies in technology as well as the financial shortfall for capital investment. Thailand has experienced such burdens for some time, and still requires support from the industrialized countries.

Most loans and grants managed by international or bilateral organizations are made specifically to cover expenses requiring foreign currency. Local expenditures are rarely covered by the loans. Aid or grants are usually allocated to expenditures for specific projects, on consulting and engineering service up to the feasibility study stage or, in some cases, up to the detailed design stage, while the foreign loans usually cover only a portion of the imported machinery and equipment

costs. These practices, which recycle the aid or loan back to the donor country, do not encourage self-reliant development.

To acheive a self-reliance in power project development, EGAT plans to take a leading role in engineering and construction management in the future, relying only on individual overseas expertise in some particular fields. EGAT needs to work with the local consultants in order to encourage the proper transfer of technology. Therefore, the following requirements should be focused on for consideration of support and assistance.

Environmental Technical Assistance

Training in environmental impact assessment and management, including control technology and specific analytical and application techniques, requires expertise in various specific fields. Requests should have been also made to the industrialized countries and the international financial institutions to take careful considerations in providing support to the non-government organizations or some environmentalists who are extremely opposed to all developments and focus solely on negative impacts. They are usually the ones which gain the most publicity in order to try to stop acceptable development projects. We do not mind hearing from them but they should not focus only on information that may be distorted.

Energy Demand Management, Conservation Measures and End-use Efficiency Improvements

We are now at the study and investigation stage and a pilot project is just going into implementation. How effective means of implementation are to be carried out is still uncertain and risky because of the different characteristics of the end-users. This will involve large investment funding. Assistance in the devel-opment of measures for greater efficiency and their proper applications in energy use should be focused particularly on electricity end-users.

Encouragement of International River Developments

The Mekong and Salween rivers between Thailand and Lao PDR and Myanmar should be developed for hydro power and multi-purpose projects.

Improved Fossil Fuel Initiatives

Initiatives are needed in:

Lignite or coal mining engineering and operation, including handling

Coal-fired power generation (conventional, fluidized-bed combustion and coal gasification) with particular emphasis on environmental control.

Further fossil fuel explorations.

7. Conclusion

Thailand is a high-growth country and is in the stage of rapid industrial development. The forecast of electricity demand in the country in the future is expected to average 10 percent yearly for the next decade. How to cope with such growing power demands will place a heavy burden on financing of the development projects, and will require long-term foreign capital investments from the lending institutions at attractive low interest rates. Technical and environmental support and assistance are still required in particular fields of expertise to enable Thailand to become self-reliant in future.

Thank you.

Colin Smallridge: Thank you, Mr. Champa for your very interesting presentation.

I was particularly struck by one aspect, namely both Mr. Champa and Mr Niazi raised the point about transferring technology to a local agency. It obviously has not worked in the past and it is a point we could dwell on a little bit in discussion as to why now, and how in fact we can make it work better in future.

Our next speaker is Mr. John Ritchie. He's presently Vice-President and Regional Manager responsible for the B.C. operations of Acres International Ltd. As a specialist in the planning and management of water resources, he has undertaken assignments in Thailand, Sri Lanka and Nepal, as well as in Canada. Mr. Ritchie holds a Bachelor's degree in Civil Engineering and a Master's degree in Water Resources Engineering, both from the University of British Columbia.

Energy and Power Sector Planning in Developing Countries

Thank you, Mr. Chairman. And ladies and gentlemen, it's a great pleasure to be here this morning to address this gathering and to participate in the panel with my colleagues from Ontario Hydro and from Thailand, Pakistan and Mexico.

I would like to look specifically at the area of energy technology that includes the planning technologies that can guide the rational and cost effective development of the energy sector in developing countries. I think most would agree that a strong and efficient energy sector is an essential ingredient of the development process and I'd like to suggest that these planning technologies can be discussed under four headings:

- broad-based energy planning,
- electric power expansion planning,
- operational efficiency enhancement, and
- institutional development.

I will be concentrating on the first three as the following panel will covering institutional develop-

ment in more depth. I will be concluding with the discussion of the roles that consulting organizations in particular can play in transferring planning technologies and I will briefly summarize what Acres has been doing in these areas.

Several recent studies carried out by the World Bank and other agencies have examined the serious problems that are affecting the energy sector in developing countries. These problems have often translated into very serious debt and institutional viability problems that threaten the sustainability of the development process in these countries. The seriousness of the requirement for capital is illustrated by the estimate that over 60 billion dollars per year in investment will be required in less developed countries over the next decade in the electric power sector.

Some of the common factors in the development of the problems are a tariff structure that cannot translate into adequate financial performance and which sends incorrect marginal cost signals to consumers resulting in wasteful consumption patterns. This, of course, is a factor that always comes up because of the need to, or the desire to provide low cost power to people to facilitate the development process. It's a difficult conundrum. There's government interference in day-to-day operations of utilities in many countries and it's often made possible by the dependency that utilities have on the central government to make up for shortfalls arising from the tariff structure.

Internal problems within the institutions on accountability and inefficiencies are often brought about by close ties to government operating rules and personnel policies, problems with planning for capacity expansion and then operational inefficiencies covering both thermal and hydro powered generation as well as transmission and distribution system operation. Now, there are encouraging signs that these problems are being recognized and measures are being taken to address them. Many countries are considering new options in terms of energy supply from the private sector and changes to institutional operating procedures and these are encouraging developments and the key issue is to look at how all of us involved in the development process can make our contribution to the resolution of the problems. I'd like to touch on broad based energy planning for a few moments.

As David Scott pointed out on Monday, energy should be regarded as part of an overall system. In the same way, we at Acres believe that it's essential to take an overview of the energy sector before delving into the details of the power sub-sector.

I'll now turn to my prepared text.

1. Introduction

The panel will discuss the following issues this morning:

What are developing country energy technology needs in both the public and private sectors ?

What is being done within each panellist's own organization, country or region to transfer appropriate technologies? and

What role should industrialized countries and international institutions play?

Increasing exploitation of energy is clearly an important element of the development process. The close relationship between per capita energy consumption and per capita GDP (**Figure 1**) can be argued to be a cause and effect relationship; increasing per capita use of energy allows the substitution of more efficient forms of energy for human labour, with a

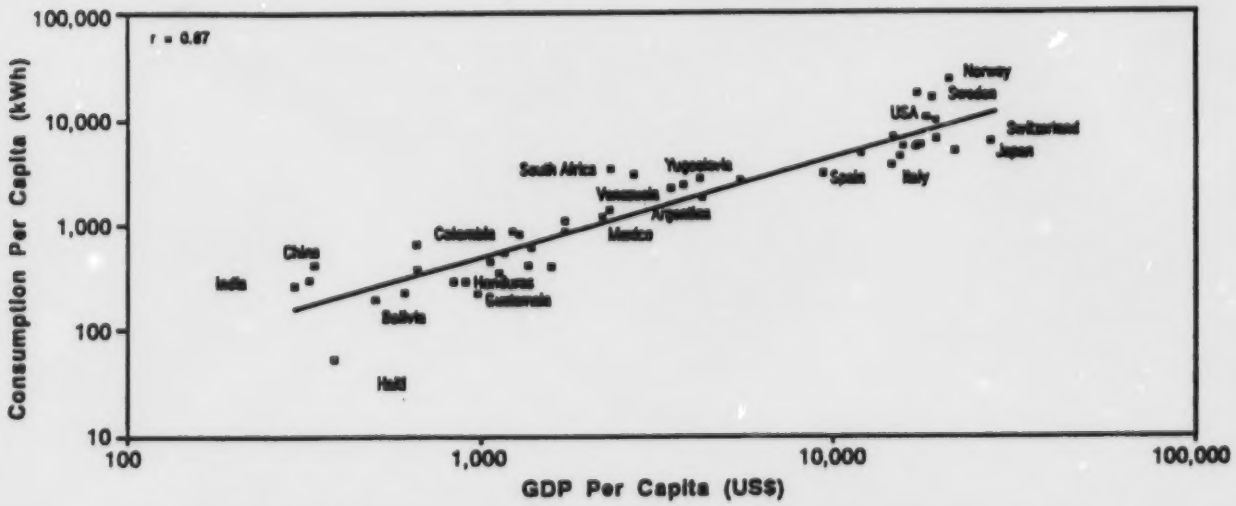


Figure 1: Relationship Between Per Capita Electrical Energy Consumption and GDP, 1988 (Ref. 1)

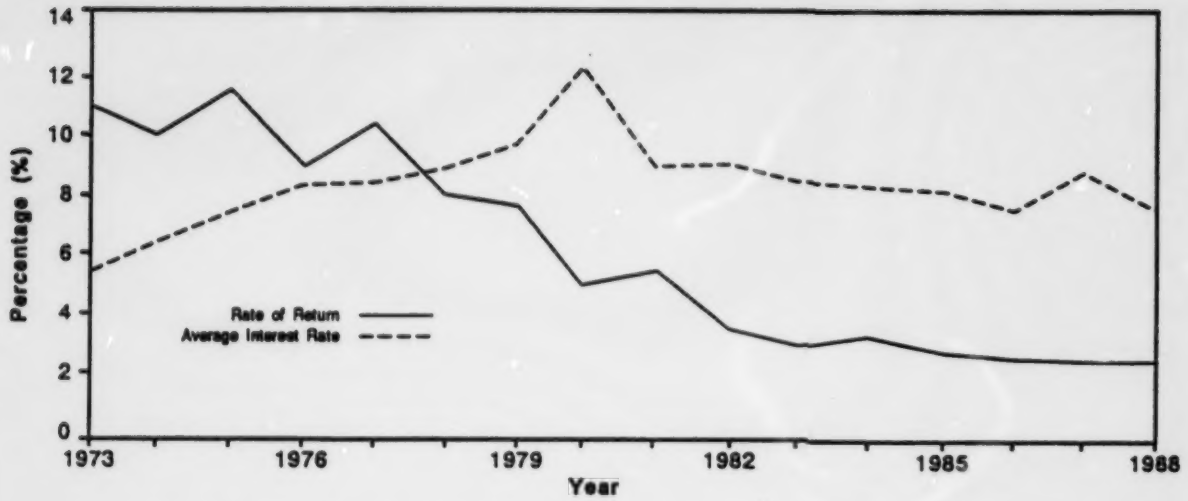


Figure 2: Return on Investment for Latin- American and Carribean Power Utilities (Ref. 1)

resulting increase in economic activity and prosperity (Ref. 2). In any case, an efficiently performing energy sector is clearly an important element of the development process.

The energy sector in many developing countries faces serious problems, some of them inherent in the development process and some of them arising from institutional deficiencies. I will discuss some of the key institutional deficiencies and outline some technologies that can contribute to alleviating them. My emphasis is placed on the following technologies:

- energy planning,
- electric power capacity expression planning,
- operational efficiency enhancement, and
- institutional development.

These technologies, when transferred with due regard to local circumstances, can offer benefits greatly exceeding the cost of transfer and implementation.

2. Problems Affecting the Energy Sector

The principal indicator of problems in the energy sector is the poor and declining financial performance of energy enterprises. In the Latin America/Caribbean region, for example (**Figure 2**), rates of return on net plant in service have fallen from the 10% level in the early 1970s (above prevailing interest rates) to the 3% level in the late 1980s (well below prevailing interest rates). Other financial indicators have also deteriorated: debt service ratios have declined drastically, dependence on government subsidies has increased, and the power sector is often unable to attract capital on the open market. This is a very serious situation for the capital-intensive power sector, since developing countries are estimated to require $60 to $100 billion per year in capital investment over the next decade to fund electric power supply needs alone. Without achieving adequate financial returns, power sector enterprises will either fail to attract the necessary capital to meet expanding demands for electric power, or they will place further demands on government borrowing capacity, which has already been severely overloaded in most cases (Ref. 3). Thus, improving the financial performance and efficiency of developing country energy enterprises is a crucial development issue.

The poor financial performance of energy sector enterprises in developing countries can be attributed primarily to the unwillingness of governments to allow energy prices to be set at levels that permit adequate rates of return to be achieved on investment. Setting of tariffs at below-cost levels, while reflecting an understandable desire to deliver energy benefits to the people at affordable prices, has also sent incorrect price signals to consumers with resulting energy waste.

Specific problems that are often encountered in power enterprises include:

- a tariff structure which cannot translate into adequate financial performance, and which sends incorrect marginal cost signals to consumers with resulting wasteful consumption patterns,
- government interference in day-to-day operations, often made possible by dependency on government subsidies to make up for tariff income shortfalls,
- inadequate accountability and other institutional inefficiencies, often brought about by close ties to government operating rules and personnel policies,
- inadequate planning for capacity expansion, and
- operational inefficiencies, including thermal and hydropower generation, and transmission and distribution system operation.

Clear signs are emerging that these problems are being recognized in developing countries and in the multilateral and bilateral technical assistance agencies. Action is being taken to revise tariff structures, introduce institutional reforms, and implement more efficient planning and operating procedures. Transfer of energy and power planning technologies can play an important part in facilitating this process, so that the energy sector is able to make its critically important contribution to sustainable development.

3. Planning for Electric Power Capacity Expansion

3.1 Electric Power in the Energy Sector

In a mature economy in which much of energy use is monetized, it is often possible to undertake electric power capacity expansion studies without undue concern for relationships with other components of the energy sector. Where it is necessary to consider these relationships, it is possible to use conventional energy pricing techniques to represent transfers among fuel types and end users. However, in less developed economies with substantial non-monetized energy consumption, it is important to place current and projected electrical energy consumption in the context of the overall energy sector. This is important for several reasons:

- many of the country's true energy problems could be overlooked by emphasizing electric power,
- conversion to electric power may be only one of the feasible energy options, due to distribution system or other cost factors, and
- electric power load growth could be very sensitive to the successful adoption of conversion programs.

Experience with energy sector studies in Nepal provides a relevant example. **Table 1** summarizes the overall energy consumption statistics for Nepal, as of the late 1980s. Table 1 illustrates the dominance of fuel wood use, much of it non-monetary, within the energy sector. Forest resources are being exploited in Nepal for fuel wood and animal fodder needs at excessive rates, due to population pressures and demographic shifts. This has placed pressure on the sustainability of rural development and the traditional energy economy, as soil quality degrades through deforestation and the increased use of animal dung for energy rather than for fertilizer. Urban consumers, a relatively small proportion of the population, are shifting away from fuel wood to kerosene, electricity and LPG, but fuel wood still dominates as an energy source in the smaller urban centres and in the rural areas. Electricity is a relatively minor energy source, although it is important in the urban areas and demand has grown rapidly, at about 14 percent per annum, during the 1980s.

Critical conclusions drawn from recent energy sector studies in Nepal can be summarized as follows:

(a) Reforestation and introduction of the rural improved cookstove (ICS) programs offer the greatest potential to redress the present energy use imbalance in the rural areas, especially in the hills and mountains.

(b) Rural electrification offers potential to alleviate energy shortfalls in the relatively flat Terai area adjacent to India, where distribution system costs should not be excessive.

(c) Micro-hydro and biogas technologies will be useful in the hill and Terai areas respectively, but probably not on a large scale.

(d) Increased electrification and conversion of industrial consumers to electricity can improve the energy balance in the urban areas.

(e) Pricing policies can have limited impacts in a largely non-monetized economy, although they can influence consumption patterns in the urban areas.

(f) Construction of large scale hydroelectric power projects based on export of electric power offers the potential to earn export revenue, and to provide low cost bulk power for increased rural and urban electrification.

In the light of these conclusions, generation capacity expansion planning studies have emphasized demand forecasts based on energy conversion and the projected progress of rural electrificatio, and the potential for hydroelectric projects for power exports to contribute to the energy sector and to the national economy. Parallel studies and implementation programs have emphasized the encouragement of improved forest

Table 1: 1988-89 Energy Demand in Nepal

Units are equivalent tonnes of oil. Adapted from Reference 4

	Wood	Agricultural Waste	Animal Waste	Petroleum	Coal	Electricity	Total
Domestic	4500	652	498	54	-	16	5720
Industrial	48	6	-	9	29	15	107
Commercial	14	-	-	22	17	3	56
Transport	-	-	-	106	1	-	107
Agriculture	-	-	-	7	-	1	8
Other	-	-	-	-	-	5	5
Total	**4562**	**658**	**498**	**198**	**47**	**40**	**6003**

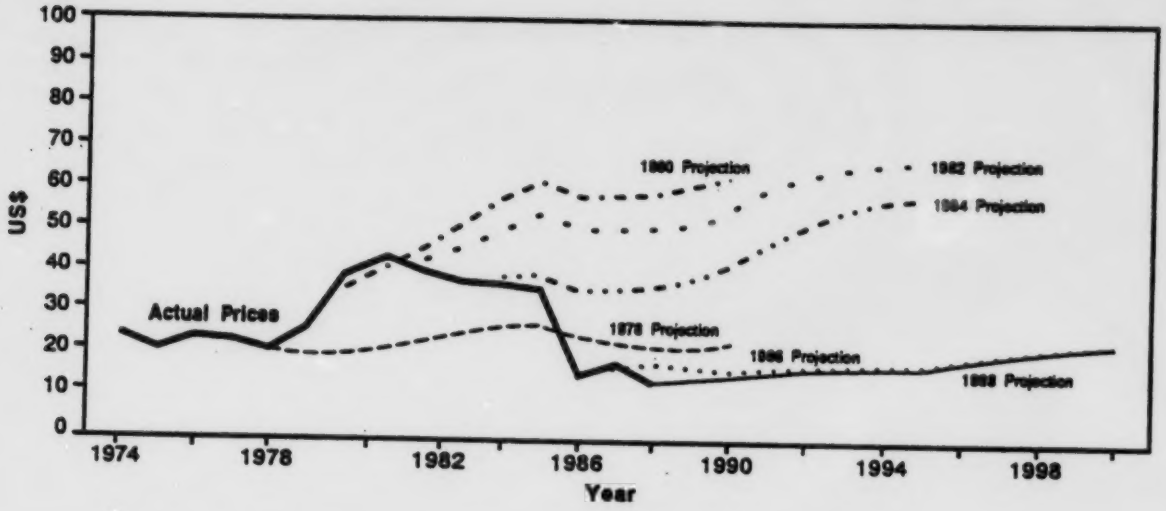


Figure 3: World Bank Oil Price Projections in Constant 1987 US$ Per Barrel (Ref. 5)

management and improved efficiency in fuel wood use, to address energy problems in the rural areas that cannot realistically be met through the use of electric power.

3.2 Electric Power capacity Expansion Plans

Capacity expansion plans for electric power in developing countries are usually formulated using classical capacity expansion methodologies based on operations research principles. The objective is typically defined in optimization modelling terms; "...subject to meeting projected load growth within specified reliability criteria, define the expansion sequence that achieves the minimum present worth cost, considering both capital and O/M costs." The WASP model, which was developed by IAEA in the 1970s and uses dynamic programming to develop an 'optimal' capacity expansion sequence, is the expansion planning model most commonly used in developing countries.

Critical assumptions to be defined before applying a capacity expansion model are:

- forecast of load growth,
- forecast of real price changes, particularly of fuels,
- opportunity cost of capital (discount rate),
- energy generation characteristics of the existing power system, and
- characteristics of candidate plants: energy yield, reliability, and capital and operating costs.

Reviews of the performance of the electric power sector conducted in recent years (References 1 and 4)

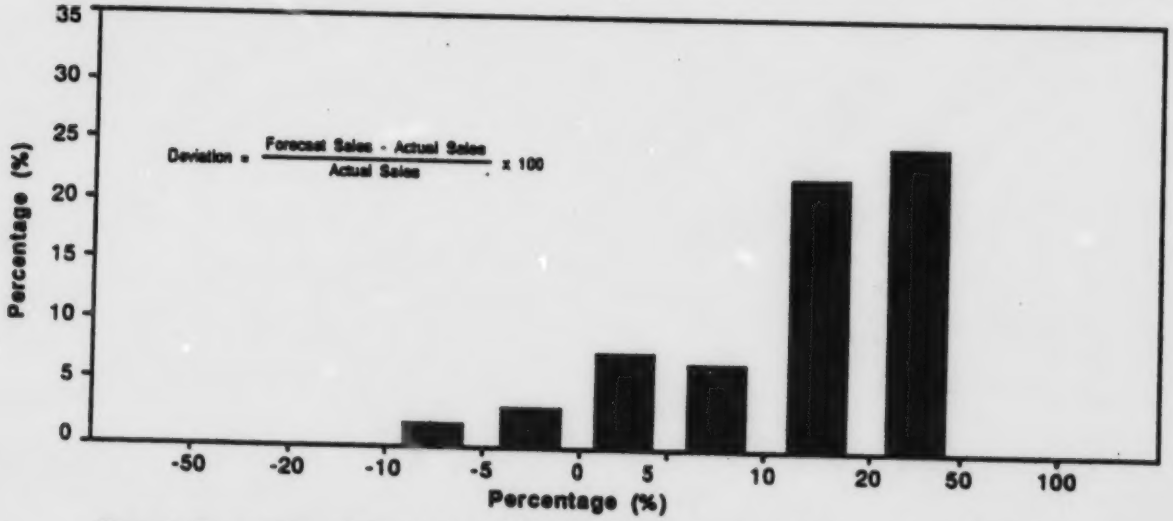


Figure 4: Power Demand Forecast Experience: Deviation Distribution After Five Years (Ref. 5)

have illustrated the magnitude of erroneous assumptions, particularly in energy price forecasts (**Figure 3**) and demand forecasts (**Figure 4**); but also in capital cost and construction schedule estimates for candidate power projects. In many cases, the inability of planners to incorporate the effects of uncertainty in formulating capacity expansion programs has led to substantial economic costs. Where demand has grown more slowly than anticipated and decisions to proceed with expensive capital intensive projects has been based on continuing high oil prices, high economic costs have been imposed through over-building of relatively high-cost capacity. Where demand has grown more rapidly than expected, where implementation has been delayed, or where plant availability and reliability have been lower than expected, lack of available energy supplies has constrained economic growth and diverted scarce resources to expensive standby generation sources.

Experience is being gained in many parts of the world with power planning methodologies that explicitly account for uncertainty, and forecasting methodologies are being refined to achieve a better understanding of the link between economic growth and electricity demand. Forecasting and plan evaluation methodologies in particular can be improved:

(a) Forecasting techniques should be refined to take into account:
- realistic economic growth forecasts,
- the effects of demand-side management measures,
- the effects of proposed changes in tariff, and
- forecasting uncertainty.

(b) Plan evaluation methodologies should be refined to place less emphasis on the development of a single 'optimal' expansion sequence. Instead, emphasis is needed on long term development strategies that incorporate flexibility and contingency planning, while treating uncertainty as explicitly as possible. Some form of scenario analysis, in which several expansion sequences are tested for their robustness under alternative forecasting scenarios, is needed.

Application of improved forecasting and plan evaluation techniques should result in better and more cost effective investment plans for the electric power sector, with substantially enhanced contributions to economic growth. Given the magnitude of required investment progress in the power sector noted in Section 1, the potential benefits are very large.

4. Operational Efficiency Enhancement

Shortages of tariff income, and foreign exchange in particular, caused many developing country utilities to neglect routine maintenance in the 1980s. This resulted in high levels of unserved energy in many countries, and high operating costs where more expensive forms of generation had to be used or where fuel consumption rates of plants became excessive. In the Latin American and Caribbean region, a recent study (Ref 1) estimated that annual economic benefits of US$5 to 12 billion could be realized through expenditure of half this amount on rehabilitation and improved maintenance. However, since these benefits would accrue in the economy as a whole, those utilities that do not receive adequate tariff income to cover their costs consider such expenditures to be financially unattractive.

Hydropower operations in many developing countries could be improved through the systematic evaluation of optimal operating policies, and through the development of computerized decision-support systems. Consideration of the following issues can often yield significant benefits in terms of reduced operating costs and deferral of capital investments in new generating resources:
- optimal operating policies developed in a power system context, considering integrated operations of hydro and thermal resources;
- evaluation of critical operating constraints and the potential for their relaxation - especially those imposed by irrigation water requirements;
- the potential to realize economic benefits through rehabilitation, especially through replacement of hydraulic turbine runners;
- the potential for improved operating decisions offered through computerized decision support systems that incorporate such information as reservoir inflow forecasts and data on present and near future system conditions; and
- the benefits achievable through operational coordination between operating entities, usually attainable through a combination of capital investments (e.g., system control centres and transmission interties) and institutional measures (e.g., coordination committees and organizational streamlining).

5. Institutional Development

As noted in Section 2, problems with institutional effectiveness in developing countries most often stem from inadequate financial viability, together with institutional factors affecting staff efficiency, motivation and training. The effectiveness of power utility institutions in many developing countries is low, as illustrated by the statistics in **Table 2**. These statistics demonstrate that indicators representing efficiency (customers and sales per employee) and viability (losses and collection period) are often poor compared with developed countries. The situation appears to be improving in some countries, but the institutional effectiveness of many developing country utilities is continuing to decline.

Experience over the past 20 to 30 years has shown that developing country power utilities can achieve high levels of institutional effectiveness, provided the following key ingredients are present:

Table 2: Power Utility Efficiency Indicators in the Late 1980s

Adapted from Reference 1; NA indicates data unavailable from this source

	Customers Per Employee	Electricity Sales Per Employee (Mwh)	Losses (Percent)	Collection Period (Days)
Developed Countries				
France	NA	NA	7	97
Italy	234	1795	8	NA
USA	156	3770	8	29
Developing Countries				
Argentina	162	699	17	225
Bangladesh	37	134	NA	NA
Brazil	143	975	13	108
Colombia	165	966	24	89
Indonesia	160	334	19	NA
Malaysia	108	569	11	NA
Nigeria	62	227	32	492
Panama	57	377	21	173
LAC Average	114	558	17	114

- coverage of capital and operating costs by tariffs, to allow financial viability to be achieved without resorting to central government funds for subsidies,
- institutional independence, allowing development of management and personnel policies that can attract and maintain high quality and well motivated staff,
- implementation of sound investment policies, based on systematic planning practices that emphasize cost effectiveness and flexibility, and
- operational procedures that minimize life cycle costs through adequate maintenance, and minimize system-wide operating costs through effective operational coordination.

6. Conclusion

Substantial benefits are obtainable through the continuing transfer of technologies related to the effectiveness of the energy sector in general, and electric power in particular:

- energy planning technologies: to place all components of the energy sector in the correct planning context, and develop overall strategies to deal with energy use,
- energy pricing: to develop pricing structures that permit institutions to achieve financial viability, while sending consumers meaningful pricing signals,
- electric power capacity expansion planning: to plan for investments in this capital intensive area to maximize its contribution to the economy, while maintaining maximum possible flexibility to address unforeseen circumstances,
- operational efficiency enhancement: to achieve the maximum possible benefits from existing assets, and
- institutional development: to create institutional environments in which sound management can be established and allowed to grow.

These technologies need to be transferred to developing countries, keeping in mind the conclusion of numerous international studies "...that the gains in productivity come not from the technology *per se*, but in having the appropriate management and incentive structures to use the technology" (Ref. 6).

Thank you very much.

References

1. The World Bank, Latin America and the Caribbean Technical Department, Regional Studies Program. "The Evolution, Situation and Prospects of the Electric Power Sector in the Latin American and Caribbean Countries," Washington, 1991.
2. Churchill, A.A. and Saunders, R.J., "Financing of the Energy Sector in Developing Countries," Industry and Energy Department Working Paper, Energy Series Paper No.14, World Bank, Washington, 1989.
3. Churchill, A.A., "Financing Energy Enterprises in the 1990s," presented at World Energy Council Pacific Regional Energy Forum, Sydney, Australia, 1991.
4. Canadian International Water and Energy Consultants, "Technical Assistance on Equitable and Efficient Energy Policies - Nepal," Kathmandu, Nepal, 1991.
5. Crousillat, E.O., "Incorporating Risk and Uncertainty in Power System Planning," Industry and Energy Department Working Paper, Energy Series Paper No. 17, World Bank, Washington, 1989.
6. Churchill, A.A., "Meeting the Challenge of Increased Energy Use," presented at the Executive Confer-

ence on Energy Technology Policy for Sustainable Development, Noordwijk, the Netherlands, 1991.

Colin Smallridge: Thank you, John.

Our last speaker before the break is Dr. Tom Drolet. Tom is the Director of the New Business Ventures group of Ontario Hydro. That group is responsible for providing the utilities products and services to worldwide markets. He established the nuclear products side of the business and then headed up all products and service profit centres. With Ontario Hydro, Tom has worked in Research, Nuclear Operations at Douglas Point and Pickering, and as Manager of the Nuclear Materials Management Department. In 1982, he formed the Canadian Fusion Fuels Technology Project, one of Canada's two initiatives for exploring energy from nuclear fusion. Dr. Drolet was educated at the Royal Military College of Canada and the University of London, England.

Training – The Most Effective Technology Transfer Method

1. Introduction

We develop relationships in our work which often last for years. Sometimes business relationships develop into close friendships which continue long after we've moved on to new jobs or even to new companies. I mention this phenomenon because it has a strong, direct bearing on my message today.

The **people network** in the international energy field is very real, and it can be of great value, if it is properly exercised. It is one of the routes through which technology is transferred from one utility to another, from one country to another.

People like doing business with people they know and trust; I know I do. Over the years, we at Ontario Hydro have found that having a network of contacts can be of great benefit, both technically and from the point of view of personal growth. It has led us to the conclusion that the best and most effective method of transferring technology is through **training**.

By training utility personnel from developing nations, either in their own country or at our facilities in Ontario, we are able to give them more for their money than by any other approach. In effect, what we are doing is giving them the capability of passing knowledge on to others in their organization, just as ripples spread in a pond. This not only allows their utility to build up a strong foundation of knowledge and skills, it also leads to long-term relationships between that utility and Ontario Hydro.

And **long-term** relationships are one of our primary goals in seeking contractual associations with utilities in other countries.

2. Utility Background

For those who are not familiar with Ontario Hydro, I would like to take a minute and explain who we are, how we operate, and where our unit, New Business Ventures, fits into Hydro's overall operation. Ontario Hydro is the provincial utility serving the province of Ontario. We are the largest utility in North America, and the fourth largest in the world. Our business is to generate and distribute electricity. To that end, we have about 32,000 megawatts of installed capacity. About half is nuclear, with the balance divided between hydraulic and thermal stations. We also have over 28,000 km of transmission lines and over 100,000 km of distribution lines to connect our stations with our customers.

As a result of our experience with virtually every facet of electricity generation and demand management technologies, our people possess valuable expertise which we can share with the world.

We also produce a variety of products as side benefits of our generation. For instance, we are the world's largest producer of Cobalt-60, an isotope which is used in nuclear medicine, cancer treatment and toxic waste destruction. And of course, our extensive Research Division develops many products and processes which are of value to other utilities.

This is where New Business Ventures Division, the international business arm of Hydro, comes into the picture. Our job is to help make Ontario Hydro's products, processes and expertise available to other countries, clients and other utilities. Although we have actively pursued such work in an organized way only since the mid-1980s, Hydro has been involved in contracts of many kinds around the world for much longer than that.

3. Technology Transfer

Our real beginning was in 1951, with the Colombo Plan. The Plan emphasized technology transfer by means of technical and financial assistance and discussion.

Although the Colombo Plan applies to south and southeast Asia – and Ontario Hydro has participated in many projects in that region – we have since branched out considerably. We are now active not only in the Pacific Rim, but also in Africa, South and Central America and the Middle East.

We work in other countries, too – most notably Eastern Europe and the United States – but I will limit my remarks to our activities in what are traditionally considered the developing regions of the world.

In all, over the last 40 years, I believe we have been involved in projects in more than 50 countries.

From this experience, we have learned many valuable lessons. The most important one, however, has been this:

No transfer of technology, whether in the form of hardware or process, can compare with the training and development of people. That is the key to long-term gains and continuing benefits.

To many, technology transfer means big-money sales of large power units. While I agree that such transactions are important to move technology from developed to developing, such deals are meaningless if they are not accompanied by a continuing program of training people to use the equipment that can be built upon.

This applies not just to high-tech items like nuclear reactors. Most countries do not have nuclear power. For most countries, a nuclear power plant is too expensive, or not needed, or not appropriate.

Everyone, however, has hydraulic or thermal stations. Every country has transmission lines. Every utility measures sales and bills its customers. Every country has an environment which must be protected. Everyone has concerns related to the wise and efficient use of all energy forms.

Ontario Hydro has expertise and therefore has something to offer the world in each of these areas. We believe that helping a utility become more efficient and more effective in the way it produces and distributes electricity, in the way it bills its customers, in the way it protects the environment, and in the way it promotes energy efficiency, is every bit as important as gaining a contract to build a new dam or install a thermal unit.

In the 1950s, it was the fashion to go after big projects. Big BIG projects. The Aswan High Dam is an example. Every country wanted a major project, as much for symbolic purposes as for any real energy need. Developed countries tended to feed this desire, because of competition between the west and the Soviet Union. Each wanted to be a bigger donor than the other. Prestige was at stake. What was best for the developing country tended to get lost in the race for Cold War alliances.

Things are very different now. A desire for huge projects has been replaced by a serious concern about the impact of those projects on river ecosystems, on rain forests, and on native cultures.

We now appreciate the value of small-scale projects which serve local needs well, rather than big projects which tend to turn local needs inside out.

The operative phrase of the early 1990s is indeed 'sustainable development.' This is a goal which we at Ontario Hydro firmly support. In fact, it is a goal which we have been pursuing in relation to individual projects since the inception of the Colombo Plan.

4. Training

When we begin a relationship with another utility, we are looking for a long-term association that will continue through the years, **through generations of employees in each utility.**

We are looking for results which will last, and which we can build upon to the ultimate benefit of the client utility's customers.

Since the 1950s, we have been training people from other utilities, either by sending teams of consultants to work with them, or bringing them to Canada to train at our facilities. I should add that the training we provide is not simply classroom instruction. We emphasize 'counterpart training,' in which their people and ours work side by side, at the actual site, day after day. People really learn the job – and they really get to know each other.

Many of the people we trained are now in senior positions with their utilities, yet we find that they remember the contacts they made early in their careers. They have fond memories of Canada; often, it was their first venture outside their own country.

These fond memories translate into firm friendships, and a tendency to look to those we know and trust when they need assistance, or when they are looking for a partner in a venture.

Over the years, we have found that the 'people element' is tremendously important. It requires a long-term commitment, but it pays off in long-term benefits.

5. Continuing Partnerships

I would like to give you some brief examples of continuing relationships that we established this way years ago. I could mention Pakistan, Ghana, Egypt, Zimbabwe and Ethiopia, among others.

In Egypt, we have been working for more than five years establishing a full training program for transmission system personnel of the Egyptian Electrical Authority. This project has been extended for a year, and we are also looking at a second phase. This was a CIDA project.

In Pakistan, our relationship dates back to the 1950s. For the last 10 years, we have focused on transmission training for their personnel. In a six-year program that was completed last year, more than 500 people received extensive training in Pakistan. As well, more than 60 Pakistani engineers and technicians came to Canada for training at our facilities.

In Kenya, we are part of a consortium in a five-year program of assistance to their electrical utility. This is another CIDA project, which focuses on training and development in two very important areas: environmental assessment and energy management.

These are only a few examples of the work that is now going on in developing countries everywhere. The old emphasis on mega-capital projects is gone. Very large projects are usually too costly. Donor countries, the World Bank, and developing countries themselves are placing a new emphasis on what some people call institutional development' and energy efficiency. This includes maximizing what they already have, and upgrading their technology base – not in quantum leaps, but in a series of smaller, more manageable steps. This is coupled with increasing demands , not least of all from the World Bank, for a commitment to environmental protection. Increasing the efficiency of what you already have is always more environmentally benign than embarking on something completely new.

6. Conclusion

Ontario Hydro was established in 1906. In the intervening 86 years, we have progressed through many stages, including, most recently, a renewed commitment to the environment. We have learned, through hard experience, many lessons which are now reflected in our way of doing business.

By passing on this accrued knowledge to people from utilities in developing countries, we help them gain the benefits without having to learn the lessons the hard way. For our part, we gain a world view in a marketplace which is increasingly globally-oriented.

For these reasons, we believe that training our counterparts is the most efficient and cost-effective means of technology transfer available to us today.

Thank you very much.

Colin Smallridge: Thank you, Tom, for a very eloquent and interesting presentation.

I'll start the question period with a question directed to all of the panellists. It reads: 'In Canada, we are told that alternate energy systems are cheap and available now. Why aren't these techniques given more importance in energy planning in developing countries?'

Eduardo Lobatón González: There are several reasons for that. I'll tackle them one by one, according to the technology involved. First of all, geothermal energy; yesterday, that was qualified as one of the alternative energies, and is, of course, subject to the local availability of the resource. If you don't have geothermal energy, you cannot talk about geothermal generation. Wind and solar are, again, limited by the availability of the resource. One major drawback in the wind energy scheme is the dispatchability. What I mean is whether the electrical network really count on a sustained, fixed, known amount of energy from wind or not? When it's available, it's a nice extra, but it can hardly be made a major component of the growing network.

Saeed Akhtar Niazi: We in Pakistan are certainly looking towards new and renewable types of energy options. Wind energy is one. But the unfortunate situation is that we do not have locations with average wind velocities high enough to give us a reasonably consistent power supply. Nevertheless, we have been in touch with various international agencies from the developed countries, and perhaps soon, we may have some windmills generating electricity on an experimental basis.

We are using solar energy to a very limited extent for pumping water, particularly in regions very remote from the national grid. But for the time being, as far as my understanding goes, it is not all that competitive.

John Ritchie: Solar photovoltaic technology is being used in some isolated areas to provide minimal basic power for a few electrical appliances in homes, and are being considered for electrical service in isolated areas as an alternative to conventional rural electrification programs which can be quite expensive. Innovations are likely to take place in these areas, possibly depending more on isolated small-scale distribution systems based on more conventional technologies which are not linked into the main grid than on solar.

Another point worth remembering is that the level of energy intensity in many developing countries is quite low, and the initial use of electricity in remote areas is often to establish some basic industries. There you are looking more at economies of scale and use of small-scale conventional technologies may be feasible.

Bronwin Boulton: I'm Bronwin Boulton of the Thompson Watershed Coalition in Kamloops. Our Coalition was recently visited by a woman from Lesotho, which is just north of the Republic of South Africa. They're building a dam there which the people don't want, as the power will go to South Africa. Their land is dried up and could use both the electricity and the water locally.

At the B.C. Environmental Network banquet, we were addressed by a woman from a small village in India with similar problems. There is a dam under construction there, and the power will be going elsewhere, to the metropolitan areas. These peoples' traditional farm lands are being flooded.

In Canada, we have, or are now forming, a public process to involve the public in decision-making that affects health, both human health and environmental health. My question addressed to Mr. Ritchie and Dr. Drolet is that knowing that we, as Canadians recognize the importance of public participation in decision-making, what are your companies doing in other nations, in the context of energy development, to assure that the public does have a chance to participate in energy decisions that affect their environment and their health.

Tom Drolet: Perhaps I could give you an example from Kenya to try and approach an answer to your question. Through a CIDA-funded contract, we have been working with the Kenyan government for five years on energy policy. This has been a group effort between our utility, York University and the Provincial Government of Ontario, all the way from energy policy formulations through to reviewing of alternate energy concepts and so forth.

We can only do what we are asked to do. It would be, and I used the word in my talk in a difference sense, arrogant of us to presume or push our ways on other countries. All we can do is within our context and our value system that we have and operate in our own country, do the best we can with the opportunities we have to take our value systems elsewhere.

John Ritchie: I can offer a further example in Nepal. Again, I am echoing what Tom pointed out regarding the great need to respect the context in which you are working, and in the case of a consulting company, the need to respect the client-consultant relationship. The consultant must be always be very careful not to step over the bound between providing informed advice and making policy. Policy-making is someone else's job.

In the case of Nepal, we have been working with Nepali authorities for some time to examine energy options and to develop an institution which is now in quite a good position to examine energy issues for itself and make policy decisions. In doing this, we have, as I mentioned, examined the issue of consumption of fuel wood, and the lack of sustainability of that process. We have been working with the Nepalese to evolve a strategy that will be rely very much on locally-based initiatives to manage forests, recognizing that if local communities regard the forest as being someone else's property, they are likely to disregard it or exploit it without considering its long-term sustainability. So in the local context we've been working towards development of systems that will work, and we feel this is the best thing we can do without violating the mutual respect that must exist between a client and a consultant.

Colin Smallridge: Thank you, John. I have two questions for Mr. Niazi. The first one: 'The wages in developing countries are low compared to those in donor countries. Is there much room for transferring more of the workload to the recipient country? How could it help the recipient countries? Is the status quo satisfactory?' That's the first part of the question. The second is: 'People from developed countries experience cultural shocks when they have to work in the third world. What are the pros and cons of having, say, hiring Pakistani expatriates already working and living in Canada, to work on Canadian aid projects in Pakistan?

Saeed Akhtar Niazi: In response to the first question: yes, salary levels in Pakistan are very low. Iit would be in the interest of the developed world to give some of the workload to Pakistan in the form of, say, subcontracting in the manufacturing sector. It would make the aid program less expensive to the donor country.

As far as Pakistan is concerned, economic activity would increase and more jobs would be generated. There would also be transfers of technology. Maybe if there's a very big subcontracting job, the developed country might transfer some big machines, lathes, computers, etc. Certainly it would be a big step toward to a transfer of technology and it will also increase GDP.

In response to the second question: First, I must doubt that, despite the cultural difference, the expatriates would get a shock. I know I have many, many expatriate friends and if they tell the truth, which I am sure they do, they simply love Pakistan. Pakistan is a very hospitable nation, and those who have worked there would like to go back again. Not only for monetary benefits, but for many other reasons, you know.

Many Pakistanis, after receiving their initial education in Pakistan, come to Canada, to the United States or to the U.K., essentially to improve their educational qualifications; generally because of the vast difference in the salary levels and the lifestyle, they opt to stay here.

Initially, we thought this was a brain drain on Pakistan's already very limited resources, so we discouraged it. Whenever there was a proposal by a donor country suggesting that they would like to send such and such Pakistani as an expatriate at such and such salary level, we didn't like it. But now we realize that Pakistanis who have gained useful educational qualifications, useful technical experience, and who are familiar with the state-of-the-art, should come back and participate in their country's development, maybe as a part of a team of expatriates. So now we welcome them.

Even now we have an Pakistani expatriate from Canada working with a firm of consultants in Pakistan. We certainly would like to encourage Pakistani expatriates working in the manufacturing industry to come over and serve Pakistan in the same manner.

Tom Drolet: Could I just add a thought to the second question? From the utility's point of view, there are two types of training and that is sending our people over there to do a job or having, and I'll use our Pakistan example, Pakistanis coming to work in our system.

The balance, from our point of view, is between the donor and financier for the job wanting the most cost-effective way of transferring the technology or doing the training, and that usually equals our people going there because, over there, nine people could train literally hundreds if not thousands of mechanical maintenance and transmission maintenance technicians and that's very cost-effective, versus Pakistan's desire to have

hands-on work experiences in our system. The actual flow turned out to be 500 person-months of work in Pakistan compared to about 100 person-months here.

In our shop, there's another division though. For instance, the tendency with a lot of Pakistani people coming into our system is to want to put them in a classroom because, again, the efficiency mentality takes over and you can transfer most knowledge in a classroom Of course, they don't want that. They want hands-on experience in our hydraulic plants or thermal plants, working alongside our people. The balance of problems there usually resolves around union problems; union workers in our plants not willing to work beside trainees from other countries, and so forth.

Colin Smallridge: Here are two questions for Tom. First, 'Does Ontario Hydro provide grants or scholarships for foreign students at Canadian universities?'

And the second asks, 'You mentioned the excellent concept of building a relationship with other country's utilities,etc., could a program be developed perhaps called 'Adopt a Utility,' to encourage large utilities to work directly with a specific developing country.'

Tom Drolet: On the first one, regarding grants and scholarships for students, I would presume the questioner means grants to come our way and work, or go to a Canadian school or university. Yes, we have one such program, but I can only say one, and it stemmed from a long-term relationship with Ghana. The basic system is that the Ghanian utility posts a notice once a year for a scholarship for a utility worker's daughter or son to come and work in the Ontario Hydro system as well as going to our schools. That's the only one I can point to. It's not a big number but the answer is a qualified 'yes.'

In response to the second question regarding adopting a utility, we call that 'utility twinning,' and yes, the theme of my remarks was basically I'm proud to say that we've worked in 50 countries with some 40 different utilities over the years. I am also practical-minded and would hope to be able to proudly say in five years that we have worked with perhaps another five or six utilities in five or six countries.

Why? For sheer efficiency, for the availability of resources and for having an effect. For a utility like ours, perhaps when I retire in ten or twelve years, I would like to say that we had an effect, a real effect, rather than just proudly saying we worked in 50 countries.

Colin Smallridge: Here's a question addressed to all the panellists: 'To be effective, is it generally accepted that the transfer of technology needs to be sustained in the long run? Yet most training and technology transfer still takes place mostly on a project-to-project basis. Could you give us some insight and specific suggestions how Canada and Canadian enterprise should present our capabilities and participate in the transfer of technology process?'

Eduardo Lobatón González: The transfer of technology process to be sustained in the long run of course implies the development of native capability to absorb, modify and further the technology received. In other words, it not only a question of knowing how to handle a specific tool, be it a planning tool, operational tool, or be expert in operation of a thermal power station. The real effective transfer of technology is realized when that particular person, or group of persons, is capable of training other people and even better, when they are capable of adapting the technology previously received into a better operational tool for their particular requirements. This often will mean that training of the recipient can be a much wider and much tougher assignment if you consider that problem. It cannot be done on a project-by-project basis. If we aim at this, it can have a real impact, in terms that the recipient eventually becomes capable enough to improve on the technology he has received, and adapt it to the particular conditions that prevail in his country.

Swarng Champa: What we feel is that the technical transfer is to be made to Thailand, for example, and regardless of whether it is in Thailand or outside of Thailand, we have invited to be trained in a certain country like United States or Canada, the point that we have some difficulty on, the major one, is the language.

Another problem, not so important as language,is that we are typically working together with the foreign advisor through his company. It seems to us that cooperation between person to person is very important. We cannot dig out what they have done, and perhaps we need to go deeper into the technology that they are providing and sometimes we cannot.

Alex Spearman: I would like to make a couple of observations. I had many years of experience with overseas projects when I worked for Monenco. I am now a private consultant in the thermal power field. In my experience, and I have quite a lot in technology transfer or technology acquisition, as I call it, because it takes two to tango, I have found that there's often been a failure on the part of the recipient to recognize the costs of this technology transfer. I agree with Dr. Drolet, a substantial amount of work has to be done here and that involves a substantial amount of money and similarly, in the recipient's country, money has to be spent. One has to be willing to persuade the client that he has to be prepared to spend one or two per cent of the cost of the thermal project on training of staff.

I can give you two quick examples of this at the opposite ends of the spectrum, both in Nigeria, where we designed and built a power station, six 120-megawatt units. The availability of that station over the last few years has been less than 10 per cent, mainly because of

lack of training in operation and maintenance. Subsequently we built a second power station, six 220-megawatt units in Lagos and we spent a lot more on training. We brought in a simulator. And that station ran very well, mainly because the contractor had a 'turnkey' contract. In the contract, we specified the amount of training he had to provide. He had to provide people at the site and after his guarantees had expired, he had to keep people at the site for five years after he had folded his tent and gone home.

The third example of that would be in Indonesia where we designed and built two 400-megawatt coal-fired units, the first large coal-fired units in that country. In conjunction with Ontario Hydro, we brought over their operating people who went and, on a one-on-one basis, actually ran that station with the Hydro people and were very well-trained. Since they went back, their station has been operating very successfully.

These are examples of what you can do. You must be prepared to spend the money, allocate the funds. And I would say to the agencies such as CIDA and the World Bank and these people, they have also got to be prepared to allow for this item in their loans.

Colin Smallridge: Ladies and gentlemen, our time is now up. Thank you all for your attention. Our first panel discussion is now adjourned.

Panel Discussion
Transfer of Technology from the Industrial World: Problems and Prospects

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

Panel Discussions

Technology Transfer to Developing Countries

Sponsored by the Canadian International Development Agency (CIDA)

Panel 2: Transfer of Technology from the Industrial World: Problems and Prospects

Panellists
Anthony Churchill
Danielle Wetherup
Peter Koelbleitner
Bill Pearson

Introduction of Panellists by Colin Smallridge

We now come to the final session, where we will hear from representatives of International Lending Agencies and companies from the industrialized world experienced in working in developing countries. They will give their perspective on the technology needs of the developing countries, hopefully acknowledging some of the issues raised by the first panel this morning. They will then comment on future problems, prospects and opportunities.

Our first panellist of this session is Dr. Anthony Churchill. He is Director of the Industry and Energy Department of the World Bank. Before his current assignment, he served as director of the Energy Department and of the Water Supply and Urban Development of the Bank. Mr. Churchill holds a B.A. from the University of British Columbia and a PhD from the University of Washington. He has published numerous papers on international development, health, urban development, global warming and energy economics. In recent years, Dr. Churchill has focused on problems of the energy sector in developing countries.

The Technology Transfer Problem

1. Introduction

In the coming decades, most of the world's increase in energy use will be in the developing world. Under even modest growth scenarios, the combination of initial low per capita consumption and growing populations will lead to dramatic increases in overall energy consumption. This has created a sense of alarm in many quarters where the concern is that this growth in energy production will place strains on both the local and global environment. Before the end of this decade, China, for example, will bring on line the equivalent of a 1000 MW coal-fired plant every month. India will be close behind.

Adding to these concerns are the poor practices and inefficiencies of energy production. Typical energy production efficiencies in these countries are one-third less than those of the developed world. Environmental concerns and pollution abatement are limited.

Two answers are usually proposed: one, improve energy efficiency, and two, introduce better technologies. Although both can help, neither one is adequate to deal with the problem. Even with the most energy-efficient scenarios, demand will decrease no more than 25 percent. And technology will not provide any magic answers.

Technology, however, does have an important, although limited role to play. Today, I would like to explore that role and in particular, focus on the obstacles and constraints to its efficient application.

2. Technology Availability

For the most part, the developing world is an importer of technology. Most of this century's vast accumulation of knowledge is available relatively freely to the developing world. The constraints of patents and technical complexity apply only to a small proportion of the technology used by the developing world. If we look at the success of the Asian 'tigers,' Korea and Taiwan, we see it is based not on the latest and most difficult technologies but rather the effective use of technologies which have been around for a long time. This is particularly true of the energy sector. The standard technologies for generating electric power are almost identical in both developed and developing countries.

The differences in performance or efficiency are not the result of the technology *per se*, but rather the use of the technology. In a recent study undertaken by the World Bank, the use and efficiency of diesel generators were examined across a wide range of countries and circumstances. Relatively identical machines produced a large variation in outputs depending on how they were used. The most significant factor affecting machine efficiency was whether they were operated by the government or the private sector. In other words, the system of incentives governing the use of the machines was by far the most significant variable in explaining the efficiency of use.

The issue of technology transfer is not an issue of machines but rather an issue of institutions. In the energy sector, these institutional issues are far more important than for most other sectors. With few exceptions, the dominant institutional structure of most energy enterprises in developing countries is that of the public monopoly. Although strong monopoly elements are to be found in energy production in the developed countries, the inefficiencies are moderated by elaborate systems of checks and balances that provide greater public accountability.

It is unlikely that effective and sustainable use of common energy transformation technologies can take place in the developing world within the constraints of the present institutional structure. A paper summarizing World Bank experience in the power sector concluded:

> "The evidence available tends to confirm that the social compact on which power utilities are based and the assumptions under which they operate within developing economies need to be re-scrutinized. Over the past decade, the decline in sector performance has been paralleled by a shift towards large monolithic government-controlled electric utilities. Although some of this rationale for concentration is still valid, there is a growing consensus about the urgent need for greater efficiency and organizational reform of the power sector."

3. Structural Alternatives

To address the issues of effective use of technology, one must focus on the effectiveness of institutions. In the energy sector, the single most important change that can be introduced is to improve the competitive environment under which energy is produced and consumed. Decades of attempting to improve the efficiency of present state monopolies with new machines and technical assistance has proven to be illusory. Improvements are fleeting, expensive, and not repeatable on any scale.

Fortunately, recent experience in both the developed and developing worlds indicates that the previously accepted view of most energy production as a natural monopoly is over-simplified. It is in fact possible to introduce competitive elements into many aspects of energy production. Where monopoly elements are strong, in transmission systems, for example, more effective and open systems of public regulation may offer a more efficient alternative to state monopolies.

Increasingly, governments are willing to explore alternatives to the present institutional structure, not for any ideological reasons, but rather because they see no other choice. Most of these enterprises are bankrupt; a combination of inadequate tariffs and poor performance has produced huge financial deficits. Governments with many pressing demands on limited public resources have no choice but to seek new means of raising the necessary capital. In this decade, the requirements for electric power alone are over US$100 billion per year.

There is no alternative but to turn to private capital markets, both domestic and international. But private capital will not be forthcoming under the present rules of the game. No private investor will put money into the electric power business unless the rules on prices and tariffs are set to provide reasonably assured rates of return. Entry and exit conditions need to be established. New forms of regulation will have to be introduced to deal with the issues of public concern.

With increasing competition and a larger private sector participation, the issues of technology and technology transfer will be of a lesser concern. Market pressures will force producers to seek the most efficient technologies. Similarly, market pressures will force producers to make effective use of the technology. It is interesting to note that much of the private interest in electric powerplant investment in the developing world is focused almost exclusively on high-efficiency combined cycle plants. In Britain, the privatization of the power sector is producing a similar technology shift.

4. Institutional Strategy

In the World Bank, we see our focus shifting from making direct investments in electric power and other energy sectors, to increasingly enabling the development of more efficient institutional structures. The elements of this strategy are as follows:

- Promote the development of arms-length regulatory bodies that would emphasize the role of the government as regulator rather than owner and producer. Improving competition and private sector participation would be important elements of the regulatory framework.
- Promote the development of capital markets by lending to financial intermediaries rather than directly to power enterprises. Power enterprises, whether public or private, would be forced to accept the discipline of financial markets.
- Encourage the use of international services rather than attempting to develop many of the needed skills on a local basis. In many countries, particu-

larly the smaller, low-income countries, a greater use of international specialization will yield substantial improvement in efficiency.

- Encourage the pricing of services on commercial principles. Instead of getting into difficult and contentious discussions on tariffs, focus simply on the bottom line. Utilities would be expected to earn commercial rates of return. Governments wishing to subsidize certain groups would have to do so through direct transfers.
- Promote greater private sector involvement through guarantees rather than direct loans.

Thank you.

Colin Smallridge: Thank you, Dr. Churchill. Our next panellist is Ms. Danielle Wetherup, who is the Vice-President of the Professional Services Branch of the Canadian International Development Agency (CIDA).

She has served in the position of Director-General in Natural Resources and Economic Development, and in Renewable Resources and in Northern Environment with the Department of Indian Affairs and Northern Development, as well as with the Intergovernmental Affairs Directorate of Environment Canada. She has held positions within the Ministry of State for Science and Technology, Department of Fisheries and Environment Canada and has been a consultant with the Department of External Affairs. Ms. Wetherup is a graduate of the London School of Economics, College of Marguerite Bourgeois, and has a B.A. in political science from Mount St. Vincent University.

Transfer of Technology

1. Introduction

Bonjour, it is with great pleasure that I take this opportunity to share with you some of the reflections of the Agency on technology problems and prospects. One of the most challenging aspects of work in the field of international development is the complexity of its concepts. It is a continual challenge to define terms such as 'sustainable development,' 'human resource development' and 'transfer of technology.' Fortunately, there is no right answer, for no sooner do we arrive at a consensus than another set of variables comes into view. Almost every morning you have to re-orient your thinking to give new meanings to old ideas, to keep up with the rapid changes.

This session's topic is no exception: the transfer of technology is a process full of complexity. Fortunately, I have been through this process before in attempting to define another equally complex concept. It may be help our discussion if I describe briefly how we confronted the dilemma of defining the concept of 'sustainable development'. My Agency, the Canadian International Development Agency, (CIDA), has developed an overall mission statement. It is deceptively simple. We believe that our mission is '...to assist developing countries to achieve sustainable development.'

You will recognize that such a definition is meaningless unless one defines sustainability. The original definition from Madame Brundtland's Inquiry on environmental issues was, and I quote, "To meet the needs and aspiration of the present without compromising the ability to meet those of the future." That was a useful starting point, as it was concerned about the environment above all. We, at CIDA, after considerable reflection, decided that we had to go beyond that definition to include other aspects. Sustainable development for us must be examined through analyses of five sets of issues. These are: economic, political, social, environmental and cultural. We call these the five pillars or concepts of sustainable development.

2. Sustainability Concepts

Let me start by explaining these five concepts. Economic sustainability means that change for the better can only occur if it is based on sound macro-economic and sectorial policies that encourage efficiency initiatives and minimize waste.

Increasingly, we have realized that economic development is linked to a healthy political environment. There is a need for decentralization of governments and more participation by citizens in decision-making. Government must create a healthy economic climate favouring improvements in productivity and private initiatives. In the energy sector that means putting in place an efficient regulatory system and sound national energy policies which are insulated from day-to-day political pressures.

Social sustainability means that basic social programs must be maintained for the most vulnerable groups and macro-economic adjustment measures must take into account the potential impact upon the poorest. Otherwise the gap between haves and have-nots will grow.

Environmental sustainability is self-evident. Unless development programs take into account the critical environmental factors, they will be self-defeating.

Finally, cultural sustainability implies that whatever we do must be in tune with our partners' cultural values. Do not discount the importance of this. Cultural factors defeat many well-designed projects in technical co-operation, human resource development and technology transfer.

The complexity of these ideas has led us to realize that achieving sustainable development is a holistic process which involves numerous considerations.

Among them is the transfer of technology. I'd like to suggest that technology transfer is an equally complex process involving considerations touching all of the five pillars or concepts of sustainable development. In fact, the very term, transfer of technology, is open to question. It assumes a linear one-way flow of knowledge, information and ideas which, once they are learned by the recipient, will be beneficial. Not only is this paternalistic, it just doesn't work that way. Technology developed to meet our needs is not always appropriate to the needs of developing countries. Also, we may learn much from the technologies developed in the south so that a more appropriate phrase might be 'exchange of technology,' with an emphasis on the need to adapt, not adopt. With those preliminary thoughts, I'll devote the time remaining to some of the key considerations for successful technology exchange by relating some of our experiences.

3. Technology Exchange Experience

The 1980s were a learning decade for development agencies such as mine and for private or public sector groups involved in development co-operation. With our increasing awareness of the complexity of sustainable development and the global economic downturn, many weaknesses became apparent in the way we used to approach development projects. We found that even when projects were designed and implemented in a satisfactory manner, the gains were often short-lived. The public sector institutions through which we worked lacked the capacity to manage and were hobbled by unsound pricing policies, over-centralized administration and massive payrolls. We found that much greater emphasis had to be given to the institutional and human resource development components of projects. Also, the environmental impact was not fully recognized and social issues, including the place of women in development equations, were overlooked. Again, new components had to be built to address these issues.

Based on this experience, a number of new perspectives have emerged. Building up the technical capacity of the recipient institution is now a critical factor in development assistance. Good development means having viable institutions well-adapted to their mission and mandate. In terms of infrastructure, this often means that a project will be built around the core components of institution-strengthening and human resource development. The objective is to transfer the know-how, and in many cases, the technology which will permit the recipient to become self-sufficient in time.

This brings in a whole new set of considerations. Our experience is that effective, institutional strengthening and human resource development requires long-term involvement. We have examples of projects extending through several phases for over a decade. An example is CIDA's support to Pakistan's oil and gas sector. This began in the 1970s with the provision of some seismic equipment and training. It moved to strengthening the oil and gas training institute and transferring the know-how which permitted Pakistan to identify and develop its oil and gas reserves. Today, our support continues by strengthening the policy-making capacity of the Ministry of Petroleum and Natural Resources. Private sector investment is being encouraged through better technical regulation and environmental pollution concerns are being addressed. Sustainability is a major concern. For example, local consulting engineering firms are being strengthened rather than creating this capability within government agencies.

We have found that creating an environment which fosters sustainable institutional development is the prerequisite for effective transfer of technology. At the heart of this is often the experience of developing a true partnership between the donor, the recipient and the public or private sector enterprise charged with delivering the program or project. Such a partnership means the recipient will play a full part in defining and implementing the program and finally in integrating the new knowledge into its day-to-day practice. Such a partnership will help to ensure sustainable transfer of technology, whether it is in the engineering training or organizational restructuring. For middle-ranking donors such as CIDA, this prospective is quite important. In the infrastructure sectors, the funds required are often beyond the capability of single donor. But that doesn't mean that we should ignore the infrastructure sector.

The link between infrastructure investment and economic development has been well proven. For instance, in Malaysia, an analysis indicates that a dollar spent on infrastructure investment stimulates twenty-five cents of private investment. In Turkey, it is thirty-five cents. In Nigeria, the deficiencies in electrical power supply provided by the public sector are so severe that there has been significant private-sector investment in captive generation capacity, despite the fact their costs per kilowatt are far greater. Infrastructure projects funded by CIDA are increasingly at the forefront. We are providing technical assistance in strategic planning, efficiency strategy, regulation policies and maintenance policies. This also includes helping our partners reform their institutional and regulatory environment. In many cases, government is no longer the sole provider of services.

A more appropriate role is in policy formulation and the creation of a climate that favours private-sector involvement. The approach presents challenges for our executing agencies, the private and public-sector groups which deliver our programs and projects. Major infrastructure projects in the future are likely to be implemented by a consortium, ready and able to take a long-term view of their involvement, and open to a true partnership with the recipients. They will need to be skilled in integrating human resource development and institution-building components into their design, and they will need a clear vision of how technology can be transferred in a sustainable manner.

4. Conclusion

Radically new approaches may be needed, particularly in those countries where public infrastructure has collapsed through economic recession and inappropriate maintenance policies. In some cases, northern firms are creating new private-sector alliances with partners in the recipient country, building and operating commercially-viable systems against the day they can be transferred to the domestic partner. Models of this include build, own, operate and transfer and build, own and operate approaches. A compromise avenue is to offer performance contracting, in which private operators agree to some benefit-sharing beyond a certain level of profit.

Recent history indicates that the 1990s will be marked by an increasing polarization between societies. Some will have the capacity to generate the right technological responses and succeed in making massive changes. They will be the leaders; others will become increasingly dependent upon technology developments elsewhere. By designing programs and projects which take into account the factors I have mentioned, I believe we will help sustainable societies with equitable distribution of development benefits.

Thank you.

Colin Smallridge: Thank you, Ms. Wetherup. Our next speaker is Mr. Peter Koelbleitner, who is the Vice-President and General Manager of ASEA Brown Boveri Combustion Systems Division.

During his 30 years with the company, he has held positions in engineering, project management, international sales and sales management. His career included a three-year assignment in New Zealand as project manager for a power station project. Mr. Koelbleitner has a Bachelor of Science degree from Sir George Williams University and is a Business Associate of the Asia Pacific Foundation of Canada. He is a Director of the Canadian Exporters' Association.

Problems and Prospects

1. Introduction

Technology transfer has been with us from the earliest days of mankind. We can trace the flow of know-how in the Bronze and Iron Ages, we can note the transfer of gunpowder chemistry from China to Europe, we can recognize how the steam engine conquered the globe, originating from James Watt's invention and there is today hardly a place in this world where Alexander Graham Bell's telephone is not in use. In all these instances, we are looking at technology transfer. Technology transfer is a natural and integral part of commerce. Our role should be to facilitate this process, recognizing it as one of the most potent competitive tools.

2. Technology Transfer at ABB

As you have heard, I work for ABB or, as some of you may refer to it, ASEA Brown Boveri. We are the world's largest electro-technical company with a spectrum of goods and services covering everything from the generation of electrical power to its transmission, distribution and use. While ABB is a very young company, having been formed in 1988 by the merger of ASEA of Sweden and Brown Boveri of Switzerland, our parents have a corporate history going back into the last century.

Technology transfer is part of the everyday life in ABB. We are established in 140 countries around the world, and with this global presence cover the complete range, from countries at the knife edge of technology to others where the challenge today consists of simply bringing electricity to the majority of its people.

Looking back, I find that our approach to the conduct and planning of our global business has changed very significantly. We used to sell into open markets and licence into closed markets. That is, we operated from our home base, measuring our business success based on the return it brought back to this home base. Today we become local, growing the business close to the market and supporting it with technology and management skills to the extent required by the local market.

In the next few minutes, I will review the three major types of technology transfer which we practice at ABB and then table a number of aspects and issues which need to be addressed in order to ensure that technology transfer is a real and long-term benefit to the recipient country.

It is appropriate to point out that technology transfer is not just an activity taking place between developed and developing countries, but is also something which is practised on a daily basis between developed countries where, however, competitive forces tend to reduce the criticality down to a corporate level rather than a national level, where it might belong in a developing country.

Let us now look at the major types of technology transfer practised by our corporation.

First, we have the technology transfer associated with capital projects when these are imported from one or more countries.

Importing capital projects involves technology transfer at several stages, such as the clients' involvement during the engineering, construction, operation and maintenance of the plant and local contractors and suppliers meeting new requirements and standards in order to compete with potential imports. Providing there is sufficient continuity of work, increas-

ing portions of such projects can be supplied from the domestic market without compromising quality or technical standards. This is an example where technology transfer is actually a by-product of a transaction.

We should really ask ourselves if the buyer could or even should give greater consideration to opportunities of negotiating distinct technology transfer benefits as part of the acquisition of an imported capital project.

Another type of technology transfer, the one perhaps most often practised by ABB, links with ABB's management philosophy of being local yet worldwide. Local companies, which often started out as importing businesses, acquire skills and know-how in manufacture and engineering, participate in the corporation's R & D efforts, and at the same time, by being close to their customers and home market, develop a competitive advantage. In this case, technology transfer is the key transaction used to drive ultimate business aims. Some of the common characteristics of this type of technology transfer are investment in local facilities, long-term business plans, a focus on a 'home market,' a strategy not just based on low labour rates and the expectation that exports will follow success in the local market.

3. Technology Transfer Examples

One example of this is the development we have seen in Malaysia, where over the last ten years ABB has moved from an operation with no local engineering to one where engineers are today the single largest group in the 250 employees. During this period, ABB Malaysia has prospered and is now a successful local company with excellent market share. Technology transfer is an ongoing process and will continue in response to the needs of the market and technological developments.

In Eastern Europe, while the situation is similar in its ultimate aims, it differs in so far as we do not start by growing a company from small beginnings but we generally inject capital, management skills and modern competitive technology into large concerns which, over the years, have been sheltered from competitive, market-driven business concepts, modern technol-ogies and up-to-date manufacturing methods. Again, however, the long-term commitment and home market focus are part of the strategy.

4. Strategy Issues

Now let us consider some of the issues relating to technology transfer:

- Local acceptance; we still sometimes find the impression that local products are inferior to imported ones. Quality control methods and qualifications to internationally-recognized standards are helping to correct this self-effacing false impression.
- Tied financing packages emphasize country of origin content and discourage true technology transfers.
- Technology must be in step with existing, or at least planned, infrastructure in order to find a fertile base to grow from.
- Educational programs must support and facilitate the local absorption of new technologies.
- Management skills must be in place or transferred in parallel to technologies, otherwise we will only lengthen the dependency on imports.
- Counter-purchase agreements, if they are the main driver for the introduction of new technologies, can provide a temporary and unrealistic feeling of success.
- Local companies, whose products and services are competitive with imports in their home market, are in the best position to grow into successful exporters.

In summary, I propose to you that a business strategy, which emphasises a global approach, based on serving regions from their local home base, will ensure that technology transfer is encouraged and that it will indeed be part of the natural market forces.

Thank you.

Colin Smallridge: Thank you for an interesting viewpoint, Peter. I am sure that our next panellist, Bill Pearson, is known to many of you. Bill is Group Vice-President of AGRA Industries Limited.

Bill is responsible for the overall direction and management of the 14 AGRA Engineering Companies, which bill over $100 million in fees annually. Prior to his present appointment in 1989, he was President of SNC International, and Senior Vice-President of Corporate Development at SNC Inc., in Montreal. He has undertaken overseas assignments in various countries including Greece, Ecuador, Costa Rica, Nepal and Upper Volta.

He holds a Bachelor's degree in civil engineering from the University of Detroit, and a Master's degree in hydrodynamics from the University of Minnesota. He has written a number of technical publications on hydroelectric developments and hydrology. Bill Pearson.

A Canadian Consulting Firm's Perspective

1. Introduction

With the recent acquisition of Monenco Group or Montreal Engineering, AGRA Industries has become one of Canada's largest engineering and construction companies. Over the years, it has undertaken many international projects in such diverse areas of activity as environmental engineering, edible oil processing, thermal power plants, hydroelectric developments, ports, harbours, and oil, gas, chemical and mineral process-

ing plants. These projects have been in a number of so-called 'third world' or 'developing' countries on all continents. To name but a few, Venezuela, Bolivia, Mexico, Surinam, Tanzania, India, Pakistan, Libya, Thailand, China and more recently, Russia. Today, AGRA operates overseas engineering offices and companies, either wholly or partially-owned, in the United Kingdom, India, Indonesia, Singapore, Iran, Philippines, Mexico, Venezuela, Argentina and Russia.

2. Institutional Factors

AGRA and its staff are experienced in working with many of the developing nations of the world. Many of these countries still suffer from a post-colonial stagnation which has seriously hampered the development of technology within their own borders. Governments reacted to colonialism with a dream of creating a perfect centralized government, where the riches of their country, which once flowed to Europe or North America, would support their Utopia. Unfortunately, in most cases, this did not happen. Under the heavy hand of highly-centralized governments, business and political leaders would no longer take risks and make decisions for fear of being wrong, and with no other alternatives facing them, development stagnated.

This was brought home recently to a senior executive from HBT AGRA, one of our earth and environmental companies, on a visit to Czechoslovakia. A Czech engineer was explaining how his local firm, a brand-new private company created by five former government employees, wanted to form a joint-venture relationship with a foreign company. But their main purpose was not technology; they weren't seeking to acquire technology, they wanted to learn how to take risks. The risks they were talking about were business operations, business decisions, and the technical risk of actually making a decision. Not the technical technology itself, in which, quite frankly, they were as advanced as we are. No, they wanted help in taking on the myriad daily decisions that the average Canadian businessman or engineer deals with on an almost casual basis.

3. Transfer Mechanisms

Traditionally, technology has referred to technical innovations in products and production processes. A developer of technology who wishes to transfer that technology abroad has four main avenues available to him: export the technology embedded in goods and services, license the technology, transfer the technology to a wholly-owned subsidiary or transfer it to a joint venture company in partnership with local firms. In all of the above methods, it is necessary to provide training both in the host country and in Canada, or whatever country it came from, with respect to the use and further development of the technology.

In the developing world, most technology transfers today are accomplished through joint ventures. One of the keys to successfully transferring technology to the third world is to be accepted as a local and indigenous company which has strong connections to the outside industrialized world. Companies should avoid the mistake of thinking they are going to be automatically accepted in a foreign country. However, by teaming up with local entities, a foreign firm can be perceived as a native company with knowledge and awareness of local customers and business practises.

For AGRA, a successful joint venture for technology transfer has been International Advanced Process Technologies, (IAPTL). This joint venture involved AGRA, the Aluminium Company of India and Indian public shareholders in setting up a company to develop, manufacture and sell edible oil-processing and environmental engineering. This joint venture was, in fact, started with the help of CIDA's Industrial Co-operation Program; the agreement was originally signed in 1987. IAPTL was recently awarded the largest private-sector contract worth $50 million with a major oil producer in India, to design and build the country's largest integrated crushing, deodorizing, edible oil-refining operation. Two years ago, it was awarded a small deodorizer plant contract by the Indian National Dairy Development Board. We have recently made a decision to move that technology totally to India. The technology was developed here in Canada but we feel that the market for it is much greater in the developing world; it has an extremely large market in India, so we have decided to move all our laboratories and two of our technical specialists to India. We will base that company and the selling of edible oil plants out of India now. It doesn't employ Canadians, but we feel it will be much more effective for our firm's future.

There are a number of pitfalls to watch for in technology transfer or joint venturing. Companies, both foreign and local, need to be sure that there is a real market for the technology they are trying to sell. Proper market research is essential. Frequently, in the euphoria of establishing a relationship, basic principles of business are forgotten. It is equally important to select the right partners and people to work with in such a venture. Technology transfers usually require considerable supervision and maintenance work after a deal is concluded. Choose your partners carefully because you will be working with them for a long time. Transfers require a lot of sustained, long-term effort, so you also need the moral and financial support of your corporate directors.

Once a technology transfer deal is concluded, a considerable effort may have to go into sustaining the process by continuing to oversee a specific project and undertaking training and further product development. Training can be very expensive, and it's a slow process, not without its own pitfalls.

AGRA's subsidiary, Canuck Engineering, has conducted extensive training programs in the last two years for Libyan nationals in its Calgary office. As part of a

refinery and pipeline refurbishment project, Canuck has trained engineers and draftsmen in Canada in the use of autocad systems. Formal training courses are set up, followed by on-the-job practical training, and students actually produce design drawings for a particular Libyan oil project. When the students returned to Libya, they were able to perform design work and drafting in local offices. Two problems did arise. Often ,when the students returned home, they were assigned to other tasks, frequently got promoted and were no longer assigned to the particular activity they were trained for. In the case of Libya, they moved on to military duty, and in two years forgot most of their new skills. A further problem upon return was that the companies they worked for did not have either the same hardware or sufficient software for the trainees to use, thus the skills they had learned were not quickly put to use and were quickly dissipated.

Further, we have been training engineers in the design of oil and gas production and processing facilities; most of this work was done on the job with specific projects, but we set up a training course with an outside instructor from the University of Calgary. We developed a comprehensive curriculum to train the engineers in oil and gas production design which they had to complete successfully before returning to Libya. This was developed in co-operation with the University. Field trips to operating facilities were very important, of course, and we also found that it was a very good idea to send the trainees to fabrication shops where equipment was being made, so that they could get a better understanding of the complete manufacturing process. In general, this particular aspect of the training has been successful.

A further benefit of the training is that it creates Friends, and I spell friends with a capital 'F.' People who, we believe, will one day definitely become decision-makers, who will frequently return to Canada, the source of further goods and services, and therefore enhance the relationship to the benefit of both parties.

Another difficulty in training occurred when Howe International, one of our companies, arranged a training program in the United States for an Iraqi customer in order to transfer dome construction technology. The trip to the U.S. was viewed as a so-called 'perk,' and so management personnel were assigned to this training program, rather than hands-on designers and workers. Without question, this program was a failure because we had expected people would be dealing with the project rather than being tourists. In the end, we had to supplement that program with other-country nationals in Iraq in order to complete the project.

4. Technology Transfer Examples

Opportunities for technology transfers exist around the world and in many different industrial sectors. Opportunities for Canadian companies exist in niche markets in Asia, Southeast Asia, Latin America and the Caribbean. The recent de-communization of Eastern Europe will also open up new markets particularly in the environmental field when environmental legislation is put in place to enforce the clean-up in that area.

Recent work undertaken by one of our other firms, HPT AGRA, in western Siberia provides a good example. HPT AGRA has been providing engineering and technical advice associated with permafrost pipelines and operation of oil-field facilities in the Western Siberia Hydrocarbon Basin. A component of our work in Siberia derives from HPT AGRA experience in the Canadian north where developed methods of mediation between developers and aboriginal people, and technical solutions to building on permafrost. In Western Siberia consultation programs dealing with issues of resource and environmental protection relevant to the aboriginal peoples has been a factor in our developing further business in that region.

These consultative processes were unheard of in Russia and their implementation by HPT AGRA caused a significant upwelling of support by the local peoples. In short, a caring and sensitive approach to the environment of local peoples has enhanced our ability to transfer technology to that region and has allowed AGRA improved access to future investment opportunities in the region.

Technology transfers, therefore, have to be viewed not only from an engineering perspective but also from the environmental and social economic perspective. We have seen a major shift from technology transfer to what I call transfer of social issues such as women and development, sustainable environmental development, human rights, health care and nutrition, to name a few.

International financial institutions also are focusing heavily on training people in other aspects of health care and nutrition, etc. So there has been some move away from infrastructure development to training and social issues. While meritorious in principle, the implementation of many of these issues is sometimes difficult and, I believe, understandably so. Many times, we have tried to transfer or impose our social and cultural standards on peoples who have a much longer history than we do, and we certainly heard that very clearly from our own native peoples the other day. Thus, countries will often pay lip-service to these issues in order to satisfy the requirements of financing agencies.

5. Conclusion

I believe that there are many, many opportunities for Canadian companies to become involved in training, and technology transfers to the developing world.

The success of these ventures, however, will depend on how well you do your homework, the people you choose to deal with locally and the political system in the country in which you work. The world is changing: no longer is it enough to transfer technology only.

More and more emphasis has to be placed on environmental, social economics and institutional issues as well.

Thank you.

Colin Smallridge: Thank you, Bill. That completes our formal presentations and we move into our final discussion period. We have invited all the panellists of the morning sessions to join us for this discussion.

The first question is for Tony Churchill, and reads: 'The World Bank is said to be quite be quite unsupportive of promoters of hydroelectric developments in the Third World, because of the large amount of capital that they need. May we know your opinion about this statement considering that these hydroelectric developments may sometimes be the most environmentally-friendly energy development choice for these countries.'

Tony Churchill: Recent reviews of experiences in building hydroelectric projects over the past several decades in developing countries have shown us that a lot of mistakes were made. In a review of some eighty-odd hydro projects, including major projects financed both by ourselves and others, we found that 50 percent of these projects had cost overruns of 100 percent or more. On average, these projects were planned to be completed in four to five years. In practise, it took closer to ten years. When we added those factors up, and included mistakes in potential demand estimations, we concluded that we needed to look very carefully at all future proposals, given these kind of past mistakes.

In many cases, when countries have come forward with hydro projects, we've said, "Hey, you've got to take another look at costs, you've got to take another look at benefits, and given the very high up-front costs of these items, the potential for mistakes are huge." Often, there are perhaps alternatives in thermal plants which may be more expensive in the short run, but are cheaper in the long run.

What we did is that we simply pointed out the weight of history to them and said you cannot go forward with these projects without coming back and taking a closer look at costs. Nevertheless, our own estimates suggest that over the next decade, from what we see coming in the developing countries, that they will construct approximately 5,000 MW of hydro power.

Colin Smallridge: A second question for Tony Churchill, which reads: 'According to news reports, agreement has been reached on an accord to limit greenhouse gas emissions. How will this impact on the lending practices of your institution to developing countries' energy projects?'

Tony Churchill: We will naturally support our customers in developing countries to meet their particular emission treaty obligations, but from what I've read about what's coming out of the UNCED process, it's not going to be very difficult. The developed world has decided that it is going to undertake limitations, but as I suggested in the beginning of my talk, it probably doesn't make that much difference to the rest of the world. As far as I can see, the developing countries have assumed very few obligations.

It's partly because of the unwillingness or the inability of the rich countries to provide the kind of transfers that would interest the developing countries. At the present, global warming issues are somewhere near the bottom of the priority list in most developing countries when it comes to environmental affairs. A major environmental issue in developing countries has little to do with energy but has a great deal to do with water and sanitation. We don't know how many people will die from global warming over the coming decades, but we **do** know that thousands are dying every day, particularly children, from inadequate water supplies and inadequate sanitation, yet I don't see many global meetings and concerns being raised about that.

From the point of view of developing countries, I don't blame them. They're not going to take it seriously because they've got far more serious problems at home, and there is a great deal of resentment that the developed world is pushing its own priorities. After all, we are the ones that put out most of the pollutants into the atmosphere. Then we suddenly decide to 'get religion' and we want to impose this on the rest of the world, and the rest of the world is saying, "Hey, wait a minute, we've got another set of priorities."

We will do our best to help our customers through this process, but what I'm saying is that until somebody puts some serious money on the table, and I do mean serious money, I doubt that much will happen. If you wanted to take care of the local pollution problems from energy, removing the SO_x and NO_x and so on, from the local pollution which affects people more directly than the CO_2, my estimates suggest that something like an additional $16 billion U.S. per year is needed just for the local pollution problems; you're not going to interest these countries in dealing with global problems until they can solve their own problems at home. And I don't see anybody coming forward with that kind of money.

Colin Smallridge: I have a number of questions for John Ritchie. They read: 'Are there countries where local bureaucracy and the local residents want a different project than what CIDA and the recipient country had agreed? How are the local residents given a voice in making decisions on projects which affect them? Does Acres carry out an environmental assessment on their CIDA project?'

'After a project is completed, is there any ongoing support available to the recipient countries?'

Finally, 'When you start and run a project in a developing country, for example, Indonesia, how do you select your project staff? Do you recruit Canadians of Indonesian origin, or do you select whoever is available in your company? '

John Ritchie: Those questions cover a lot of ground.

The first question dealt with project formulation. How is a need articulated and a project put together to address that need? That is a long and complicated process. In the early stages, it typically involves CIDA staff and the recipient country's officials, and by the time the project is formulated to the point where it can be addressed by a consultant, the terms of reference are established and a framework has already been developed within which the consultant must work. That typically also includes provisions for emphasis on environmental assessment, women in development, and other issues of that type.

As we know from dealing with CIDA over the past few years, these issues have become increasingly important, so virtually all projects that we handle with CIDA have important elements addressing the needs of women in the project context and dealing with environmental issues. This is something the consulting industry in general, and certainly Acres in particular, supports because we believe that a project that addresses these issues will be a better project.

The details of staff selection and formulation of environmental assessments take place as part of the project process. When selecting staff, we will normally try to select the best-qualified staff to carry out the project. There are many considerations including academic qualifications, experience in the recipient country, language capabilities and ability to work sensitively in another cultural environment. All of these elements must be considered when staffing. It is complicated.

Quite often, it does happen that the best person for the job is a national of the country concerned. We have a case, as Mr. Niazi mentioned, of a Pakistani citizen who moved from Canada back to Pakistan on one of our CIDA projects. So there are some success stories in these areas and I think increasingly so, because of the increasing focus on addressing some of these broader issues rather than simply focusing on a narrow project objective.

Colin Smallridge: I have two questions addressed to Danielle Wetherup: The first reads: 'Is there an ongoing mechanism in CIDA to ensure that the intended results of CIDA projects are actually realized in the recipient countries?'

The second question is: 'In Iran and recently in Saudi Arabia, the U.S. and other developed nations exported foreign technology and foreign personnel to create instant foreign communities. There was a backlash in Iran and it is likely to happen in the Middle East also. Is CIDA making sure that we don't create similar problems?'

Danielle Wetherup: The impacts of the projects are measured in two ways. First of all, whether the project has been delivered according to its intention, and we have a number of mechanisms to do that, including assigning monitors for the duration of the projects. The second aspect is to evaluate whether the project has had the result intended and that I think, is much more complex evaluation and it does lead to reorientation of the policies of the agency. One of the major elements of policy direction that has been taken was pursuant to the evaluation of the impact of our activity and is leading us to move from project delivery to program delivery, to a reduction of the number of sectors that we are involved in and hopefully an ability also to reduce the number of countries that we are involved in. So, 'yes' is the answer to both the physical realization and the development impact questions; there is an ongoing evaluation.

With regard to the dangers associated with community implants in developing countries, the resources of Canada in the aid programs are not so large that it would allow us to do that to begin with. We are present in most developing countries, in about the middle of the range of contributors, and, as I explained before, our focus is increasingly to influence institutions and to deal with the front-end of programs and human resource development and institution development. So therefore, I don't believe we will fall into that danger.

The other advantage we have offered for a great many years, I think since the agency was initiated, is that we have a well-recognized, efficient briefing centre which ensures that any consultants, or CIDA employees, including their families, are offered a cultural briefing and are offered training pre-departure on the realities of social, cultural, economic and environmental aspects of the country that they are going to be working in.

Colin Smallridge: This question is directed to our guests from abroad, 'Based on your experience, can you help us to identify the weaknesses, and if you wish, the strengths in Canada's delivery of technological assistance?'

Saeed Akhtar Niazi: In my particular case, I would say that in respect to Canada's assistance to Pakistan, I must acknowledge with gratitude that the Canadian assistance has been very generous and very useful in many sectors, in the energy sector for oil and gas and particularly the power sector.

I take you back more than thirty years, to soon after the independence of Pakistan, when Canada built us the Warsak Dam. This was the first major breakthrough in the exploitation of our hydro-electric potential. It was a

beautiful example of international cooperation, and the Warsak Dam construction acted as a big nursery for the training of the Pakistani engineers, technologists, and technicians. More than 100 graduate engineers got actually on-site training, and about 10,000 draughtsmen. The local people laid down their guns and used the dynamite for blasting the rocks. It made a very great cultural change and those very people who got trained in the construction industry they later on rendered useful service on other projects within the country and also abroad in the Middle East and African markets. So I must say that Canada's assistance has been very useful; and it is still continuing.

One example is the construction of a power house. Canada also built us a nuclear power station, another power station, a small turbo-station, and now this transfer of technology process is continuing. There have been various programs. One was an initial utility training arrangement, although it was not named as such. We had very good co-operation with the Canadian utilities.

Then it was followed by hydro-electric ranking studies and institutional development, transmission-training studies and institutional development. Snowpack survey studies are currently proceeding. CIDA is helping us, through of firm of consultants, to prepare our national power plan which incorporates improvement in the planning process and also institutional development. I must say that this reminds me of one of our learned speaker's remarks yesterday that Canadian society is 'communitarian'. I couldn't agree with him more.

Eduardo Lobatón González: Just to give you another side, we in Mexico have had an ongoing agreement with Hydro Quebec for training purposes when we were setting up our laboratories for high-powered high-tension testing. This proved to be quite useful. I think that they provided us with the expertise that we required, and we are very grateful for their help.

Now, what I don't see, just to come back to the other side of the question, is any ongoing aid activity, that is tapping the tremendous growth that the energy sector is going to have in developing economies, as Mr. Churchill recently mentioned. What type of technology can be, or should be developed to better attempt that huge market? It seems that we are in a contradiction. Investment in the electrical sector has been steadily diminishing in industrialized nations, because obviously you don't need additional capacity. You have reached a plateau, but the market for new technologies in generation, transmission and distribution and new operating techniques is still there and I think it should be tapped.

Colin Smallridge: Here is another question for Tony Churchill: "Recent reports in the press, for example, *The Globe and Mail*, have focused on the issue of transfer of technology money to the third world countries. Despite billions of dollars that have been transferred over decades, the standard of living has often declined, for example, in Africa. So the question is: 'Where is the West failing?'"

Tony Churchill: That is a very big question. I agree with you that there has been enormous waste in this. In Africa over the 1980s, something close to $4 billion a year was spent on technical assistance and training. It's very hard to see any result of that, and one has to come back and ask the question why, and I have thought quite a bit about this. One of the reasons I think is that the developed world tends to treat aid as charity on the one hand and on the other hand, as a device for meeting its own particular political imperatives.

There is not much listening going on out there. It's not that we're sitting down with the developing world and saying, 'Hey what are your problems?' The present global negotiations on climate point that out, where you've got a bunch of rich folks sitting down saying here's the problem that we think is going to come in our backyard and maybe it will make a difference and maybe it won't. They're not hearing what the priorities of the developing world are. Similarly, when you come down to specific instances, the extent to which our aid programs are driven by commercial concerns, by political concerns — if you take a look at the large bulk of what is called aid money, most of it is going in to meet political concerns. You know, we'll give you so much a year in exchange for military bases, or for not invading your neighbour, or things like that.

The bulk of aid money does not go into anything like aid, it goes into meeting the objectives of the developed world, not the objectives of the developing world. So I suspect that's a very large part of the answer.

Let me bring a specific example home here to Canada. Every time we have an energy project, it inevitably generates some controversy. There are people who disagree about moving people from their ancestral homes because a dam is being built, who don't like coal, or don't like burning natural gas or have all sorts of concerns. Rather than get into the middle of this and help those countries make the difficult decisions about the trade-offs that their societies want to make, the developed world, the rich folks, are backing out. They're saying this is too controversial, when we get into political problems back home, let's withdraw. A prime example is the Three Gorges project in China, a tremendously difficult hydroelectric project rated at 17,000 megawatts. Now Canada, to date, has provided some very useful and helpful advice and support which has helped the Chinese come up with, I think, a better and better project as the time goes on.

But now it has become too controversial to some groups in Canada who don't like it, who oppose it, and

so, instead of sitting down in the kitchen and negotiating this thing out, you are withdrawing. And I see that in country after country, and it's very harmful because the Chinese will build this project, and they'll build it their own way if they build it without your help, which could be very useful.

If they don't build it, they will build seventeen 1,000 megawatt coal-fired plants instead, and think what that will do the atmosphere. But unless you are prepared to sit down at the table, you're just not going to be part of it, and I think that's a great pity. As a Canadian, I find myself at times embarrassed by the unwillingness of our own government to tackle and help out with the controversial issues.

Colin Smallridge: Ladies and gentlemen, as I said at the outset, many Forums often devote two or three days to the subject of technology transfer, so predictably we've run out of time this morning. I hope those of you in the audience have learned something today about the very complex problems of technology transfer.

On your behalf, I'd like to thank all the panellists for their presentations and I would ask you to join me in showing our appreciation.

We are again going to hear from our Conference Chairman, Mr. John Sheehan, but this time he's wearing a slightly different hat, and will appear as a member of the Executive Committee of the Energy Council of Canada instead of as a senior officer of B.C. Hydro.

Closing Remarks by John Sheehan, Conference Chairman

First, I do would like to express thanks to all of the speakers that we've enjoyed hearing during Energy Forum '92.

This morning we heard of the tremendous opportunities that exist throughout the world in our particular industries, anything relating to energy. We heard about the growth and Pakistan alone looking at 10,000 megawatts in the next ten years. And Thailand looking at an annual growth rate of 13 to 15 percent. We in B.C. may have some relation to that, because that was about the rate we were growing at in the 1960s and currently we're down to around the 4 percent, which we find is still fairly tough to handle.

We considered the meaning of technology and technology transfer, and I think it's very appropriate that we now really know what we mean by these great phrases that we throw around so glibly nowadays and often don't stop to think what they do really mean. What I got out of it is that it means training, training and more training. But where? It means training to sustain whatever benefits us, and I think very appropriately it was brought to mind that means the ongoing day-to-day operations after getting a project into operation. The composition of the trainees, who are the beneficiaries and the teams, we heard about that this morning and that is a very well worth while idea to bring into any of our groups.

We in B.C. can certainly relate to the native people, and we heard from Bill Wilson who talked strongly about them not yet being able to fulfill their particular place in our society. I think it's equally necessary that we give recognition to the futures of the different peoples, difference societies, different countries and the world that we are trying to build for the next generation and the generations to come.

As I said, in my opening remarks on Sunday, on behalf of the Energy Council, on behalf of B.C. Hydro, and I'm sure on behalf of CIDA and the other sponsors, we are very grateful for the attendees for the attention that they brought to all of our sessions, and we particularly want to thank those people who came from so far away, to attend this Forum and bring us the benefit of their views and to exchange their views with us. Hopefully, we will all go away a little bit richer than we were when we arrived last Sunday.

Supplementary Materials

Efficiency, Trade and the Environment

May 10 – 13, 1992
Victoria Conference Centre, Victoria, B.C.

BC hydro

Issues

Partnership with aboriginal people "will make Canada a great country"

Canadian society has to adopt a new relationship with aboriginal people based on mutual respect, Bill Wilson, political secretary of the Assembly of First Nations, told the fifth annual B.C. Hydro Energy Forum.

"Power of any sort, be it electrical or political or persuasive or moral power, has always been removed from us," Wilson said. "Aboriginal people have simply been ignored as if they did not exist. Their concerns and their interests are of no importance whatever to the things that go on in this country."

He told a packed auditorium, "the assumption upon which this country was based was that aboriginal people were inferior and non-aboriginal were superior. We see it in all our institutions. Non-Indian people are superior, their religions are superior, their form of government is superior, therefore let us impose them on the aboriginal people."

The prevailing attitude of non-Indians, Wilson said, is to complain "if only Indian people would understand the wisdom of our knowledge and experience, then everything would be wonderful. Who cares if they've got 30,000 years on the land. They say, well, they're just Chinese people that came over the ice bridge. That's nuts."

Bill Wilson earned a standing ovation from delegates for his inspiring address.

Carbon dating of sites on northern Vancouver Island and elsewhere in B.C. indicate that 10,000 years before the ice bridge theory came into existence the aboriginal people had sophisticated societies equal to the Greeks and Romans. Wilson added: "The problem is, this has never been recognized."

"I don't make threats," Wilson told delegates. "But you are going to have to understand that if we are going to develop in a fair and honest manner, we are going to have to abandon the assumption that

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B.C. Hydro's fifth annual Electric Energy Forum, held May 10 -13 at the conference centre in Victoria, was judged a success by organizers and the more than 450 delegates who attended over four days. This year's forum was held jointly with the 14th Canadian National Energy Forum under the banner "Energy Forum 92." Inside Issues, look for:

Climate change "no fad..." 2
B.C. leads provinces in public involvement 4
Forum Diary 6
Canada needs national policy strategy 8
Carbon dioxide could be collected and put to good use in industry 11

Climate change "no fad — solution lies in action"

The world community must take immediate action to offset the potentially disastrous effects of global climate change, according to one of Canada's top negotiators of the agreement presented to the Brazil '92 United Nations Conference on Environment and Development.

Doug Russell, director of the Climate Change Negotiation Office, Environment Canada, told delegates, "First of all let's be clear about one thing; climate change is not the latest environmental fad. It's not a political movement. It's not a new age Holy Grail or some doomsday apocalyptic nightmare. It's real and it's going to happen even if we stop greenhouse gas emissions at midnight tonight."

Doug Russell (right) talking to delegates.

Some of the most eminent scientists in the world have reached a clear consensus, Russell said, that "we cannot continue to do business as usual." Yet uncertainties and doubts exist.

He added "time and time again" during negotiations leading up to the international agreement presented to the Rio conference it was clear "we do not have time on our side, we must take action now."

To get an idea how fast greenhouse gases are growing, Russell said, half of the carbon dioxide added to the atmosphere in all of

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Former opponent recalls B.C. Hydro as 'Darth Vader'

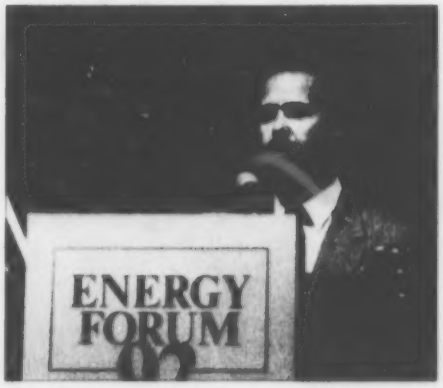
The era, now long gone, when B.C. Hydro was regarded as the enemy by some energy and environmental activist groups was briefly recalled at Energy Forum '92.

Bob Jamieson, a rancher in the East Kootenays and member of the B.C. Round Table on the Environment and the Economy, was the luncheon speaker on the first full day of the forum. He spoke about the successful efforts to involve the public in round table discussions. Then he touched on the changing attitudes of both sides in the debate over resource development.

"I want to tell you about an experience when the Round Table first started up," Jamieson said. "We were looking for volunteers for the energy subcommittee and Mike Halleran, another member, looked at me and I looked at him and we both kind of rolled our eyes. During the era of dam-building in the Kootenays, Halleran and I were major opponents of many people from B.C. Hydro who are in this room."

Jamieson added: "In the old days, B.C. Hydro was Darth Vader incarnate to us. So I walked into our first subcommittee meeting feeling like Luke Skywalker. I got up there and I turned on my light sword. Bzzz. Remember that one? And Darth came up and he turned on his light sword. Bzzz.

"I was getting ready for a fight when he said, 'Have you seen my new light sword? It uses 30 per cent fewer watts. It's Power Smart.'"



Luncheon speaker Bob Jamieson.

Jamieson said there has been attitude adjustment and change on every side in the debate over resources and the environment. "We have to look at changing these attitudes if we are going to resolve the very difficult problems that face us all," he said. "It's absolutely crucial that we understand that's what we are about in the nineties."

Darlene Barnett, vice-president legal and corporate secretary, came to the podium to thank the speaker. "I was one of the people involved in the old days when Hydro was the Darth Vader who was trying to license those hydro projects," she said. "It's a lot more fun now.

"The orientation then, if not confrontational, at best consisted of two points of view that seldom met. (But) we never had a forum like this where we could discuss things informally and try to come to a consensus. I think we are now doing that more and more. We thank Bob Jamieson for his speech and his analogy. It's a lot nicer to be working with you, Bob, rather than against you."

Collaborative conservation effort draws praise from delegates

B.C. Hydro received high marks from delegates at Energy Forum 92 for its commitment to the on-going collaborative review of the province's electrical energy conservation potential over the next 20 years.

Dick Gathercole, a member of the collaborative committee until his recent appointment as head of the B.C. Energy Council, told the forum: "I've learned a great deal from my participation in the collaborative (process). I have gathered a lot of ideas that I will be taking forward in my new work with the Energy Council."

Jack Habart represents Hydro on collaborative committee.

He said one of the reasons the committee has worked so well is "because B.C. Hydro was really committed to it and the staff was so committed to it. We did start out with some concerns, a lot of us, that the process might be taken over by the staff. We found out very quickly that wasn't the case. I think that was absolutely essential to the success."

Gathercole paid tribute to Nancy Cooley, the consultant who chairs the collaborative committee. "She was unanimously chosen by all the participants in recognition of her skills," he said. "The success of the collaborative is due in no small part to her role as chair."

Cooley earlier described the events leading up to the establishment of the committee of 13 members representing major areas of interest in Hydro's service area. Hydro didn't select the members who speak on behalf of 33 umbrella organizations throughout the province and indirectly for hundreds of smaller organizations.

The committee actually runs the review for Hydro. All its decisions are mutually agreed upon. The committee's final report is expected to be made public early in 1993.

"Picture yourself sitting around a table with 12 other individuals," Cooley said, "many of whom are representing organizations that you have been in less than cordial relations with, some of whom have been in open confrontation over the years, and you will understand there was some trepidation. Then saying, 'Okay, we're going to sit here until we can reach agreement. That is precisely what we've been doing for a little better than a year."

Power Smart's Jack Habart said he was initially concerned the collaborative process would take too long and produce a poor quality product. Neither fear was borne out. The process has taken about 20 per cent longer, he said, but the broader participation has brought "a wider range of values into the study."

"I believe that the quality of the product that we're getting out of this process is much better than we would have had otherwise," Habart said.

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B.C. Energy Council will help resolve issues

The unresolved issue of long-term firm power exports is one example of why B.C. needs the Energy Council, Anne Edwards, Minister of Energy, Mines and Petroleum Resources told a luncheon audience at Energy Forum 92.

"There has been no formal public consultation on this issue," Edwards said. "There are views, very strongly held, at almost every point on the spectrum but there is probably no consensus."

The minister added public concern focuses on "the effects of exports on our long-term electricity supply and certainly on our environment. We need a serious and balanced public review to protect the public interest on this issue."

The previous government announced several years ago, Edwards said, that B.C. would export electricity on a long-term firm basis. She added, the Socred minister insisted there would have to be a project up for review by the B.C. Utilities Commission before the public got an opportunity to say whether they thought this would be a good idea or not.

"I think we need to put first the idea that British Columbia needed public involvement in energy planning," Edwards said. "The government wants two communication. We are going to put the machinery in place so that we can have that communication.

"We need to coordinate all our energy sources; traditional supply, demand side management, new technologies, alternative energy sources, and the Columbia River Treaty downstream benefits. We are committed to account for environmental impacts. We have to work together to balance our objectives."

B.C. leads provinces in public involvement

British Columbia emerged as the leader in public involvement activities during an Energy Forum panel discussion involving energy ministers of three western provinces and the head of Ontario Hydro.

Debating the topic Energy Development in Canada: Where do we go from here?

Marc Eliesen, chair and CEO of Ontario Hydro, joins B.C. Hydro as CEO in November.

were Anne Edwards, B.C. Minister of Energy Mines and Petroleum Resources; James Downey, Manitoba Minister of Energy and Mines; and John Penner, Saskatchewan Minister of Energy and Mines. The session was chaired by Marc Eliesen, chair and CEO of Ontario Hydro.

B.C. wants maximum benefits from the province's resources with minimum impact on the environment, Edwards said. "We want a strong thrust in the direction of conservation and efficiency. But we are going to have a hard time talking conservation unless we make it part of the efficiency argument.

"In real terms British Columbia has lots of resources. And when you have lots of resources, the public generally does not see the need to conserve for conservation's sake. So what we have to look at is efficiency. I believe most people recognize that value is not just economic but ethical as well."

To achieve this goal, Edwards told delegates, "I firmly believe we must find ways to involve the public in decisions in which the public demands to have a say. One of the key answers is the formation of the B.C. Energy Council."

During the question period, Donald Scarlett, a delegate from the Kootenays asked the other panelists what public involvement initiatives had been taken in their provinces.

Penner said Saskatchewan has its own public involvement process and has just completed a round table on the environment and review of a clean air strategy. The province is also setting up a new body to consult with stakeholders on the development of new energy sources.

Manitoba has no overall public involvement program, Downey said. Rate increases go before the Public Utilities Board and environmental issues are reviewed by an environmental panel.

Eliesen said Ontario has an "active and involved process" of environmental review on major energy projects but no specific public involvement program. In his introductory comments, Eliesen recalled the kind of question being discussed was formerly a challenge only for professionals and technicians.

"The criteria were simple," he said. "Is it technologically feasible? Does it make economic sense? Once that was settled, you drew up specifications, got financing approvals, and before long the river was dammed or the generating station was going full tilt.

John Penner, Saskatchewan Minister of Energy and Mines.

James Downey, Manitoba Minister of Energy and Mines.

"I know that to get such things done today is infinitely more difficult. Whether it's a hydraulic site or a nuclear plant or a transmission line, it's going to have an impact on somebody's backyard.

"By the same token, when somebody today says 'not in my backyard' they might be talking about a patch of lawn behind the house or the backwoods of Ontario. They might mean the Brazilian rain forests or for all I know they might mean the Sea of Tranquillity on the moon.

I'm sure most of you agree the environment is everybody's business. The energy business and a lot of other businesses can't make a move without considering what it will mean to the world. And I do mean the world around us."

Developing world needs efficient pollution controls

The most efficient way to deal with global environmental issues may be to spend money on pollution controls in developing countries, according to experts discussing the topic of Western Canadian Energy in a Global Context.

"Would you like to see a 30 per cent reduction in world carbon dioxide emissions?" Giacomo Capobianco, president of the Coal Association of Canada, asked delegates attending the Energy Forum '92. To achieve this Canada must find a way to transfer to the developing countries "not the leading edge technology — just the technology we are using in this country today."

Capobianco added: "Just get China, India and Eastern Europe to use that kind of technology and you'll get a dramatic reduction in carbon dioxide emissions."

Canada has increased its efficiency in coal-generated electricity by 400 per cent since 1900 and this efficiency could double again with technology that is being examined today. Meanwhile, coal is used to produce over 40 per cent of the world's electricity and this will increase dramatically with the expected sharp rise in global population and industrialization.

Ian Smyth, president of the Canadian Petroleum Association, agreed that "in terms of bang for the buck" emission controls in Canada are now so stringent that new investment in those areas "will reap diminishing returns."

"By contrast," Smyth said, " in countries like China which are heavily dependent on industrial facilities with inefficient or even non-existent emission controls, good opportunities exist for investment. If you look at the question globally, where would it make sense to put money if we want to reduce carbon dioxide emissions? To me the answer is clear.

"We should help developing countries put in better emission controls. This would reduce emissions by orders of magnitude for the same environmental dollar."

Bill Gatenby, chairman of Cameco Corporation which produces uranium in Saskatchewan, noted China recently started operating its first commercial nuclear plant to generate electricity. The new plant supplies two per cent of the country's electricity needs.

"I'm not suggesting the solution to China's carbon dioxide emissions is to stop burning coal and build nothing but nuclear plants in future. I think it's a problem that will be improved with better stack management, better quality coal at the right place — and some nuclear, some oil and some gas. But it does demonstrate there are many solutions to this problem," Gatenby said.

Some thirty delegates from 10 foreign countries attended Energy Forum 92. Speakers from Mexico, Thailand and Pakistan, together with specialists in foreign aid, participated in panel discussions on energy technologies required by developing countries.

Forum Diary

The record attendance included representatives from more than 50 non-profit environmental organizations, aboriginal bands, and educational groups throughout B.C. and the Pacific Northwest. There were 30 delegates from a dozen overseas countries in attendance, including:

People's Republic of China delegation headed by Vice-Minister of Energy, Hu Fuguo is responsible for the coal industry.

Stan Hatcher, CEO of Atomic Energy of Canada Ltd., summing up the forum, told delegates the Canadian position for the World Energy Congress conference in Madrid this fall "is based on presentations and panel discussions" at events like Energy Forum '92. He said: "I want to assure you that a forum like this is functional. It's not just a get-together to swap stories. We actually try to make use of the output from it."

Judith Myers, Associate Dean of Science and Agriculture at the University of B.C., acknowledged the support shown by B.C. Hydro over the years to women in science. "As I look over this audience, which must be 99 per cent male, I realize that one almost totally untapped source of energy in Canada is women in the energy field," she said. "I hope that in 10 years time if one looks out at this audience there will be more women filling the seats."

Anne Edwards, B.C. Minister of Energy, Mines and Petroleum Resources, noted her department has co-sponsored the forum since its inception. The minister said: "I know from personal experience that the conference offers an opportunity to discuss all aspects of energy. We're not just talking supply, but environmental impact, resource utilization, and public attitudes. So go to it. I hope this conference proves to be a worthwhile and revitalizing experience for all of you."

Scotty Cameron, CEO of Pan-Alberta Gas Ltd., and chairman of the Energy Council of Canada, reminded the opening session that "we are the Canadian participant in the 90-member-country World Energy Council which is preparing to hold its 15th World Congress in Madrid this September." The World Energy Council is a non-governmental body dedicated to promoting the sustainable use of energy for the great benefit of everyone. The theme of the Madrid conference is "Energy and Life." Dr. John Foster, a Canadian who heads the world body, spoke at Energy Forum '92. He was praised for his "enormous contribution over 20 years to the technical and administrative activities of the WEC."

Trade in energy technology key to environment

Derek Davis was the keynote speaker.

The keynote speaker at Energy Forum '92 warned that the overwhelming "energy poverty" of developing countries ensures fossil fuels will remain the primary world source of energy and perpetuate "the greenhouse threat."

Derek Davis, executive director of the World Energy Council Commission, was addressing more than 450 forum delegates in the Victoria Conference Centre.

"The basic problem with energy is the same as the basic problem with food," Davis said. "We have plenty of it now and are likely to have plenty of it in the future. But the distribution is faulty. Many who have enough, waste an awful lot of energy. And, as with food, the situation would be immeasurably worse without trade in energy."

The speaker added: "But trade is not the whole solution to energy poverty any more than it is the solution to hunger. People need to be able to buy food and energy. They also have to be able to grow their own and to provide their own energy, particularly if they are unable to buy."

Davis said the challenge facing the global energy industry in 1992, looking ahead to the first half of the next century, is to provide energy through trade and supplement it with another form of trade in energy technology. Now roughly a quarter of the world's population is entirely dependent on imported energy, with no resources other than some minor traditional fuels.

The World Energy Council Commission's regional reports all show the immediate priority for the developing world is the non-availability of commercial energy to a majority of the population. Davis said: "They do not see global warming as a priority, and solving the problem of energy poverty will be pursued without regard to global effects."

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Partnership with aboriginal people

men are superior to women, white people are superior to coloured people and that Indians are inferior.

"Even though you may not articulate it in your mind or in your voice, the reality is that especially when we talk about power corporations etc., the things we do are based on that assumption.

"I believe if we will abandon our assumption of superiority, of rightness, look each other in the eye, we will start to make decisions based on mutual respect and dignity. I was raised as an hereditary chief and told the responsibility of great leaders is to make sure the weakest among them is protected from the few and the powerful. That's what leadership is about."

Wilson cited the insensitive treatment of Indian people whose lands were flooded behind the W.A.C. Bennett dam and the Kemano power project. He added: "Obviously we need energy for industry to provide jobs. But why didn't they, 25 or 30 years ago, go and talk to the Indian people up river? Why didn't they do the environmental assessments to understand what flooding would do to the salmon? Because they didn't care.

"They didn't think they needed to. Somehow they were not born with the moral fibre that said, 'Listen, the weakest among us must be the ones that are protected.'"

He predicted that if Canada incorporates the interest, energy and talent of the aboriginal people, by enshrining the inherent right to self-government in the constitution, "this will be one of the greatest countries on the face of the earth."

Wilson received a standing ovation from delegates at the end of his speech.

Canada needs national policy strategy

To be competitive in the global marketplace Canada must excel in the effective use of all of its resources, Carl Beigie, chairman of the Canadian Foundation for Economic Education, told Energy Forum delegates.

He was one of six speakers taking part in panel discussions focusing on competitiveness in the energy sector.

"As a nation, we've spent far too much valuable time debating secondary issues like who owns us," Beigie said. "No nation in the world has the capacity to offer more than Canada. We must refocus on the services available for anyone who wants to locate here."

Beigie went on to outline a seven point national policy strategy:

- We should plan for the best use of our arable land and fresh water.
- We must concentrate on maximizing value added to our non-renewable resources before export.
- We must secure energy availability at or below world prices.
- We must try to set world frontiers for transporting goods, services and people.
- We must recognize telecommunications are the railways of the late 20th and early 21st centuries.
- We must start using our aging population and comforting the aging process.
- We must see that everybody continuously enhances their skills.

Jack Habart, then manager of planning and evaluation for Power Smart, was a member of the efficiency and competitiveness panel. He told delegates the collaborative B.C. Hydro study of the industrial sector shows potential of about 37 per cent in energy reduction over the next 20 years.

Energy Forum 92 drew a record 450 delegates.

The collaborative is now studying how much of this potential is actually achievable. Habart said, "We have to start looking at all those real world constraints. Then say, okay, when we're estimating B.C. Hydro's additional electricity requirement for program planning, how much can we realistically hope to achieve over the next 20 years. That's really the difference between the technical potential and the achievable potential.

Letter of thanks

Dear Mr. Guelke:

I wanted to write to you to thank you very much for the opportunity to help in the planning committee for the 92 Forum. I very much enjoyed the planning process and the forum itself.

Also, many thanks for your support and encouragement on the T.V. program on Climate Change and Ozone effects. Hydro's support of this and other environmental initiatives marks Hydro as a key player in the search for solutions to our environmental problems.

I also appreciate very much Hydro's support of the "Save the Earth" series of broadcasts. I watched most of the programs and they were very informative.

I very much look forward to working with you in the future. Also, please pass on my sincere thanks to Andrew Baker.

Bruce Torrie
Chair, Atmosphere Caucus
B.C.E.N.

Joint action by utilities could meet future needs

Growing public awareness, heightened environmental concerns, and rising cost factors should lead utilities into more joint ventures to meet future power needs on the West Coast, according to one expert from Bonneville Power Administration.

Gary Fuqua, deputy assistant administrator of BPA's Office of Energy Resources, participated in a panel discussion on trading Western Canada energy. He told delegates, "We believe utilities have opportunities to use exchanges and storage to fill niches in product needs and sales. We need to take the broad perspective for our mutual benefits, underlining mutual."

He added: "Making the pie bigger by exploring multi-party arrangements could create an environment that goes beyond win-lose."

B.C. with its winter peaks, storage potential resource base and the Pacific Northwest with its winter peaks and non-firm energy transmission system could enter an agreement with California, which has summer peaks and a thermal system. Fuqua said, "These agreements would be cost effective and a better alternative for the environment than constructing new resources."

Fuqua said, "We don't believe utilities can afford any more to go it alone from an environmental or a cost-effective standpoint."

Ed Schreyer, former governor general and Manitoba premier, chaired the panel discussion. He told delegates he didn't want to get involved in policy discussions but added, "In the case of the export of hydro electric energy, I think that's about the closest things there is to a win-win situation. You are not detracting from the sum total of tomorrow's generations where there is a sale or an exchange to capture the benefit of seasonal diversity. It's a real benefit."

Schreyer noted, however, all questions touch on energy indirectly involve the environment. "No form of energy yet is totally environmentally benign," he said.

Guy Saint-Jacques, energy counselor at the Canadian Embassy in Washington D.C., rejected the suggestion that the Free Trade Agreement was an American plot to steal Canadian resources. "The commercial reality," he said, "is that prosperity cannot be built on resources left in the ground."

Saint-Jacques said the FTA provides the framework that allows each province to decide what it wants to do with its electricity. He added, "I don't think it's a sell-out of Canadian resources."

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Climate change "no fad" continued

human history was emitted in the last 30 years. Methane levels have doubled in the past 100 years. Chlorofluorocarbons (CFCs) are doubling every 10 to 20 years.

"It's tempting to say let the industrialized nations put caps on everything and we will solve this problem," he said. "Industrialized nations are only part of the problem. In 1950 the U.S. accounted for 45 per cent of carbon dioxide emissions. It's now down to about 22 per cent. The United Kingdom is down from seven to three per cent. At the same time the former Soviet Union has increased from 12 to 19 per cent.

"China sitting on the world's largest coal reserves with the world's largest population has increased from two to 11 per cent of the world's emissions; India is up from one to three per cent. "

For countries where emissions are rising, he added, there is a one-word explanation: development.

"That is the crux of what the UN conference and the climate change convention is all about. So we can't say, 'It's one set of countries' problems, they have to do it all.' Everybody has to work together," Russell told the forum.

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Collaborative conservation effort

Phil Larston, B.C. Energy Coalition, described the collaborative process as a good way to develop understanding between sectors. He said his own participation has broadened his perspective of all the factors that go into decision-making and "enabled me to evolve and become more mature."

Don Scarlett, Electrical Consumers Association, said some West Kootenay residents felt "a great deal of skepticism (and) downright antagonism towards B.C. Hydro because of a sense of exploitation" arising from large hydro projects.

"Through this process we are coming to grips with those feelings," Scarlett said. "B.C. Hydro and its stakeholders are working together. It's early in the process, but if we continue with this very enlightened beginning I see a great future."

Discussion groups continue to evolve

The B.C. Hydro Energy Forum marked the fourth year in which discussion groups were held with a broad range of interest groups. Jim Savage, one of the organizers, noted one major change and delegates from the floor suggested others.

Savage said the session devoted to the B.C. Round Table on the Environment and the Economy marked the first time Hydro has hosted another group to have a discussion group at the Forum. He added: "It will be interesting to hear how that went."

Lee Doney, executive director of the B.C. Round Table, said the opportunity to debate its report "is an exceptional opportunity." He added: "I would like to see this happen more in the future, not just with Round Table documents, but others out there in the public domain."

Doney said the Energy Forums are a cost-effective way of broadening discussions on public issues. "It was nice to see a lot of people who already participated through our stakeholder processes and public forums," he said. "But we also saw a bunch of new faces offering new perspectives. So from our perspective it was a very worthwhile initiative."

Tim Bradshaw, a Greater Victoria teacher who brought a group of students to take part in the discussion groups, took one of floor microphones for reassurance that solar energy was being considered. Bradshaw said, "Given that we have an expert here on solar energy, a lot of the kids talk regularly about why don't we (install) solar panels out in the clear cuts. Can I take some optimism back to the kids?"

"I'm afraid not," said Ezra Auerbach, who summarized the workshop on B.C. Hydro and Public Involvement. "Solar electric modules are fine, very compact generators of electricity. They are made in factories. They are not made by cheerful happy workers. I have never seen them singing on assembly lines.

"Importing technology to put on our clear cuts to generate electricity will hardly make the dent in our children's lives that conservation will. What you want to tell the kids in your class is that they should think before they put one article in the dryer in the morning so they can wear it to school. That's going to have a far greater impact than solar panels on houses."

Another delegate Glen Sinclair suggested that students should be invited to participate in next year's forum. "Maybe they'd help us show that both sides (in the energy debate) have some important things to say. I felt in our group that happened."

Carbon dioxide could be collected and put to good use in industry

Carbon dioxide, one of the culprits often blamed for the greenhouse effect, is one of the "really valuable" commodities in the world today, according to Dr. David Scott, director of the UVic's Institute for Integrated Energy Systems.

"It is important where carbon dioxide comes off," Scott told Energy Forum delegates. "If you compress natural gas and use it directly in a vehicle, the carbon dioxide comes out of the tail pipe and off it goes into the atmosphere. But you could also convert the natural gas into hydrogen, using the steam reforming process, and then fuel your vehicle with hydrogen.

"If carbon dioxide is considered an environmental problem, you can collect it while you are reforming the natural gas and sell it again. It's easier to collect at a stationary source," Scott added.

NASA uses the steam reforming process to produce hydrogen fuel for its space craft, Scott said, "and we'll do that when we have fuel cells that can exploit the characteristics of hydrogen. In this case, carbon dioxide can come out in a very pure stream at a stationary source."

So instead of being discharged into the atmosphere as a pollutant, carbon dioxide could be collected and put to a number of industrial uses, Scott said. Carbon dioxide is used for tertiary oil recovery and for carbonating light beer and soft drinks.

John Hollins, associate science advisor for Environment Canada, said computer modelling shows Ontario would not be able to cut carbon dioxide emissions 20 per cent by the year 2025 without the continued use of nuclear energy.

Speaker David Scott, right, answers questions from delegates.

Sixth Annual Energy Forum set for Victoria

Ray Hunt, B.C. Hydro's president and Chief Operating Officer, reminded delegates that B.C. Hydro's sixth annual Electrical Energy Forum will be held at the Victoria Conference Centre May 2 - 4, 1993. He said this year's event, combined with the 14th Canadian National Energy Council forum under the banner of Energy Forum '92, created a synergy that "has worked well."

"When Bob Wyman made his opening remarks," Hunt said, "He commented that it was most important to B.C. Hydro's decision-making process that we reflect the values of the people we serve. There is no question in my mind that any public approval process will run more smoothly for Hydro, if we can demonstrate to our regulators that we have adequate and active involvement with our stakeholders."

He told delegates: "I want to assure you that the results of the forum are distributed and discussed within business units and will influence our activities. We consider that real value added to our process."

Ray Hunt, president and COO.

Long hours of hard, dedicated work go into the planning and running of a four-day conference. Hydro's own Communications Planning staff carried the major responsibility for the success of Energy Forum '92. The pictures on this page show them at work behind the scenes and long after the day's sessions

FORUM SPONSORS

The forum was jointly sponsored by:
B.C. Hydro, the B.C. Ministries of Environment, Lands and Parks and Energy, Mines and Petroleum Resources, and the Energy Council of Canada (formerly CANWEC), with additional support from Powerex, Power Smart, Power Smart Inc., West Kootenay Power and Powerserv Pacific Inc.

Issues

Published by Corporate Communications
B.C. Hydro, Dunsmuir 16
333 Dunsmuir Street, Vancouver, B.C. V6B 5R3

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Recycled Paper

ISSN 1181-6430

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